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PHYSICS ABSTRACTS

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SECTION A OF SCIENCE ABSTRACTS

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Physics Abstracts

	PAGE
MATHEMATICS	703
ASTRONOMY. ASTROPHYSICS	703
PHYSICS	705
Fundamentals	705
General mechanics. Mechanics of solids	—
Mechanical measurements	710
Mechanics of fluids	710
Molecular theory of liquids	711
Mechanics of gases	712
Molecular theory of gases	712
Vibrations. Acoustics	712
Optics. Radiation. Spectra	715
Heat	720
Thermodynamics	723
Electricity	723
Electrostatics. Dielectrics	723
Electric conduction. Currents	724
Electric discharges	734
X-rays	735
Cathode rays. Positive rays	736
Discharge tubes. Ionization. Thermionics	739
Cosmic rays	741
Magnetism	743
Electromagnetism. Electrodynamics	747
Electromagnetic waves and oscillators	747
Nuclear and Atomic physics	750
Apparatus. Particle detectors	750
Elementary particles	751
Nucleus	757
Radioactivity	759
Nuclear reactions	762
Atoms	767
Molecules	768
Solid-state physics	771
Structure of solids	774
Elasticity. Strength. Rheology	777
PHYSICAL CHEMISTRY	778
Phase equilibrium. Chemical reactions	778
Electrochemistry	779
Photochemistry. Radiation chemistry	779
Dispersions. Colloids. Adsorption	780
Chemical structure	780
Chemical analysis	780
CRYSTALLOGRAPHY	780
X-ray crystallography	780
GEOPHYSICS	782
Atmosphere. Meteorology	782
BIOLOGY	784
Medical science. Human physiology	784
TECHNIQUE. MATERIALS	—
Photography	—

The number printed above each abstract on the right is the Universal Decimal subject classification number; the abstracts are arranged in order of these numbers throughout each issue.

The monthly Author Index, List of Journals, Errata and Notes follow immediately after the last page of abstracts.

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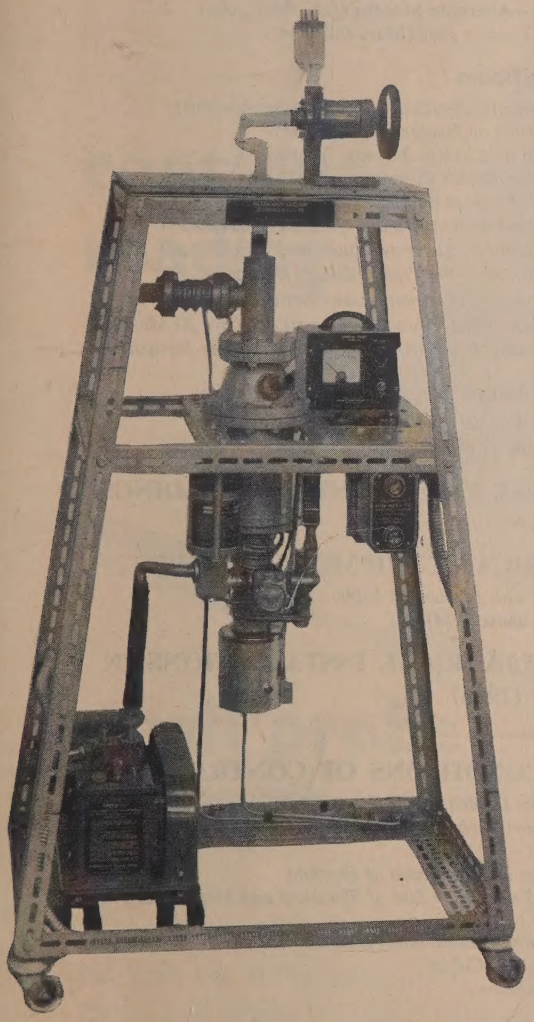

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PHYSICS ABSTRACTS

Volume 61 NOVEMBER 1958 Number 73

MATHEMATICS

517.3

7644. NOTE ON THE FOURIER METHOD OF INTEGRATION OF THE EQUATIONS OF MATHEMATICAL PHYSICS.
I.Kravtchenko and A.Apté.
Ann. Inst. Fourier, Vol. 7, 329-58 (1957). In French.

A simple but rigorous account of the Fourier method of integration and its validity in the case where the solution has singularities on the boundaries. The domain of definition is limited to a rectangle. The method of forming a Fourier series whose sum is the solution to a given differential equation with specified boundary conditions is described in detail. M.J.Kearsley

517.544.2 : 518.5

7645. EXPERIMENTAL CONTINUATION OF HARMONIC FUNCTIONS AND ITS GEOPHYSICAL APPLICATION. D.Zidarov.
C.R. Acad. Bulg. Sci., Vol. 11, No. 1, 17-20 (Jan.-Feb., 1958).
In French.

The problem is to determine the value of a harmonic function at various points in space from its values on a specified plane. The method is to reproduce the values on the plane by values of the magnetic potential of a suitable system of coils and to determine the values of the potential and its derivatives at points above the plane. A.H.Cook

517.9 : 537.311.33

APPROXIMATE SOLUTION OF $d^2u/dx^2 - \sinh(u) = -f(x)$. See Abstr. 6975

518.5 : 539.17

EASY COMPUTATION OF ADJOINT FLUXES IN NUCLEAR REACTORS. See Abstr. 7407

518.5 : 539.17 : 621.317.79

XENON-POISONING COMPUTER. See Abstr. 7409

ASTRONOMY . ASTROPHYSICS

523.164.3 : 551.594.5

7646. AURORAL RADIATION AT 500 Mc. T.R.Hartz.
Canad. J. Phys., Vol. 36, No. 6, 677-82 (June, 1958).

An observation of radio-noise emissions at 500 Mc/s from a type-A red auroral display, which occurred on 21-22 October 1957, is reported. The circumstances surrounding this phenomenon are considered, and the unusual display is linked to a large flare on the sun some 30 hr earlier. It is concluded that an unusually large particle flux for the ejected solar matter would produce sufficient ionization in local regions of the ionosphere so that auroral radio emissions would be possible. A.

523.164.32

7647. POLARIZATION MEASUREMENTS OF THE THREE SPECTRAL TYPES OF SOLAR RADIO BURST. M.Komesaroff.
Austral. J. Phys., Vol. 11, No. 2, 201-14 (June, 1958).

A swept-frequency technique was used for measuring the polarization of solar radio bursts occurring at the beginning of the present sunspot cycle. Of special interest were the results for bursts of spectral type III. Contrary to the inference drawn from earlier work, it was found that many of these bursts are highly polarized. Furthermore, there were strong indications that the polarization is produced at the radiation source and is not imposed by propagation conditions in the overlying media. A.

523.164.32

7648. EVIDENCE OF ECHOES IN THE SOLAR CORONA FROM A NEW TYPE OF RADIO BURST. J.A.Roberts.
Austral. J. Phys., Vol.11, No. 2, 215-34 (June, 1958).

A new spectral-type of solar radio burst is described. The bursts contain two elements, the second being a repetition of the first after a delay of $1\frac{1}{2}$-2 sec. In each element the frequency increases with time at a rate of 2-8 Mc/s per sec. The bursts are of very short duration and are confined to the longer metre wavelengths. Occasionally they occur within, and evidently form part of the structure of, a burst of spectral type III. It is suggested that the second elements of the bursts are echoes of the first, reflected from lower levels of the solar corona. If the burst radiation is assumed to occur at the second harmonic of the coronal plasma frequency, the delay between the elements can be quantitatively explained providing the coronal density gradient is 1.5 times steeper than in the Baumbach—Allen model. Two alternative explanations of the rising frequency characteristic are considered. Either the exciting disturbances travel in through the corona at speeds between 2 and 5×10^4 km/sec, or the outward travelling disturbances responsible for type III bursts encounter "hills" of electron density in the corona. A.

523.164.32

7649. STATISTICAL INVESTIGATIONS OF SOLAR RADIO BURSTS ON 200 Mc/s. Ø.Hauge.
Astrophys. Norveg., Vol. 5, No. 8, 227-40 (May, 1956).

A total of 9773 solar radio-bursts from three different noise-storm periods in July and August 1955 are examined. A mean exponential amplitude distribution law is determined. There seems to be no distinct difference in the peak-amplitude distribution between two of the periods examined. In the third period a deviation is found, probably caused by a variation in the burst-generating mechanism in the solar corona. No difference in character of the amplitude distribution at the beginning, middle and end of the active periods is found. The distribution law therefore seems to be independent of the depth of the burst-generating regions in the solar corona. The amplitude distribution in the three periods investigated shows a hump at an amplitude of $3.7 \times 10^{-22}\ \mathrm{Wm^{-2}\ (c/s)^{-1}}$. This indicates the possible existence of a mechanism causing emission of specific burst amplitudes or burst energies. No variations in the mean burst amplitude is found during short-lived changes in the noise-storm activity. A.

523.164.32

7650. DURATION AND BAND-WIDTH OF SHORT-LIVED TRANSIENTS IN SOLAR NOISE. T.de Groot.
Nature (London), Vol. 181, 1676-7 (June 14, 1958).

With a two-channel receiver covering the frequency band, 394-406 Mc/s, with one channel fixed at 394 Mc/s and the other variable, the half-power bandwidth of the average frequency profile of small solar "bursts" was measured for channel distances from 1.5 to 12 Mc/s. Assuming a Gaussian profile, the weighted mean value of the bandwidth is 13.6 ± 2.6 Mc/s. Although the equipment can resolve a time difference of 0.02 sec between events in the two channels, no cases have occurred of bursts at two different frequencies in the band with a time separation greater than this. D.R.Barber

523.164.42

7651. ON THE THEORY OF SPORADIC RADIO EMISSION OF JUPITER. V.V.Zheleznyakov.
Astron. Zh., Vol. 35, No. 2, 230-40 (1958). In Russian.

A brief review is given of the available information on the radio emission of Jupiter, followed by a discussion of the hypothesis that this emission is caused by plasma oscillations in Jupiter's ionosphere. This hypothesis can explain the main characteristics of the emission and leads to some valuable information on the physical conditions in Jupiter's ionosphere. Quantitative results derived from the above hypothesis indicate that Jupiter's ionosphere is very similar in its parameters to the F2 layer of the earth's ionosphere. It is possible that the recently-discovered sporadic radio-emission of Venus can be explained in a similar way. S.Chomet

523.164.42 : 621.396.677

7652. ABSOLUTE MEASUREMENTS OF RADIO-ASTRONOMICAL SURFACE-BRIGHTNESSES AT 198 Mc/s WITH A 90° CORNER REFLECTOR. B.H.Grahl.
Z. Astrophys., Vol. 45, No. 1, 49-67 (1958). In German.

The relationship is discussed between the apparent noise-temperature of an aerial and the temperature-distribution within its main beam. Corrections to the intensity-scale of the 200 Mc/s survey by Dröge and Priester are obtained, and are confirmed by a comparison with Baldwin's 81 Mc/s isophotes-map. The spectral intensity-distribution of the general (background) r.f. radiation within the range from 81 to 200 Mc/s is derived. A.Beer

523.164.8

7653. THE REFLECTION OF RADAR SIGNALS FROM THE SUN. F.H.Bass and S.Ya.Braude.
Ukrayin. fiz. Zh., Vol. 2, No. 2, 149-64 (1957). In Ukrainian, with summaries ($\frac{1}{2}$ p.) in Russian and ($\frac{1}{2}$ p.) in English.

Theoretical paper in which the reflection of radio signals from the solar corona is treated as scattering from a rough surface. On account of the sun's rotation there will be a Doppler effect and hence a frequency spectrum in the reflected radiation. Analysis of the spectrum yields information regarding the mechanism of e.m. wave scattering by the corona. The latter part of the paper is devoted to a determination of the optimal conditions for separating signals from noise. C.R.S.Manders

523.164.85 : 621.396.8

7654. A THEORETICAL RATE–AMPLITUDE RELATION IN METEORIC FORWARD-SCATTERING. C.O.Hines.
Canad. J. Phys., Vol. 36, No. 5, 539-54 (May, 1958).

The theory of the forward-scattering of radio waves by ionized meteor trails is applied to the development of a rate–amplitude relation. This relation expresses the anticipated occurrence rate of scattered signals which exceed a chosen amplitude level, as a function of that level. It is compared with preliminary observational data, and found to be in good agreement both qualitatively and quantitatively. Closest agreement is obtained only with an appropriate choice of two scaling factors. These provide an abstract of the observations in a form which is convenient for further study and interpretation. A.

523.164.85 : 621.396.8

7655. THE FORWARD-SCATTERED RADIO SIGNAL FROM AN OVERDENSE METEOR TRAIL. P.A.Forsyth.
Canad. J. Phys., Vol. 36, No. 8, 1112-24 (Aug., 1958).

A recently presented expression for the forward-scattered signal from an over-dense meteor trail is tested by applying it to the signals scattered from a single meteor trail. The particular trail was selected carefully in order to permit the derivation of each of its parameters in several different ways. The internal consistency of the derived information is taken as a measure of the validity of the theoretical expression. In particular, the electron line density at each of two reflection points is derived by three different methods, of which two depend upon the new expression, and the other depends only upon well-established theory. The resulting agreement is within the experimental error and suggests that the new expression is an adequate working relation for use in experimental investigations. A.

523.59

7656. THEORETICAL EXPLANATION OF GEGENSCHEIN DUE TO LIGHT SCATTERING BY SPHERICAL PARTICLES. H.Walter.
Z. Astrophys., Vol. 46, No. 1, 9-16 (1958). In German.

The surface brightness of gegenschein due to interplanetary dust is calculated from Mie's theory and compared with the results of observation. It is shown that, in addition to absorbing particles, dielectric particles are essential to give the measured brightness, but very large dielectric particles can only be present in quite small numbers. H.G.Jerrard

523.7

7657. FIRST OBSERVATIONS WITH THE SOLAR POLARIMETER. A.Dollfus.
C.R. Acad. Sci. (Paris), Vol. 246, No. 26, 3590-3 (June 30, 1958). In French.

First results with a solar polarimeter (Abstr. 6574/1958) are reported. Near the limb, the solar photosphere shows very slight polarization varying from one zone to another with change of sign, being zero on the average. Active centres near sunspots are associated with transient polarization of small amplitude. Within the spo regions the polarization may attain $\sim 10^{-2}$%. The instrument is sufficiently sensitive to reveal polarization of coronal light caused by free electrons, and thus may be used instead of the coronagraph for observations without an eclipse. D.R.Barbe

523.74

7658. THE WILSON EFFECT IN SUNSPOTS.
R.E.Loughhead and R.J.Bray.
Austral. J. Phys., Vol. 11, No. 2, 177-84 (June, 1958).

New observations of the Wilson effect in a small regular sunspot have demonstrated the reality of the phenomenon. The measurements are based on 38 photographs selected from some 24000 obtained during the passage of the spot from to the east to the west limb. It is pointed out that the changing appearance of a sunspot during its passage across the disk is essentially a problem in the theory of radiative transfer. On the basis of a simple model a qualitative explanation is found for the Wilson effect and for the anomalous foreshortening of sunspot areas. A

523.74

7659. THE LIFETIME OF SUNSPOT PENUMBRA FILAMENTS.
R.J.Bray and R.E.Loughhead.
Austral. J. Phys., Vol. 11, No. 2, 185-90 (June, 1958).

Twenty-seven photographs of a sunspot showing a particularly distinct filamentary structure are analysed in order to obtain an estimate of the lifetime of the penumbral filaments. The photographs have been selected from some 2400 taken over a period of 5 hr. Although the measurements are rendered somewhat uncertai by observational difficulties the results clearly indicate that some filaments remain identifiable for periods of the order of hours. A

523.74

7660. BEHAVIOUR OF THE PRESENT SUNSPOT CYCLE.
S.W.Visser.
Nature (London), Vol. 182, 253-4 (July 26, 1958).

By means of 27.2753 day running averages the Zurich spot-number data from 1899 to March 1958 has been smoothed, and a ne curve constructed to show the spot activity over the entire period. From this it has been possible to predict some features of the pres cycle. The primary maximum occurred in October, 1957. Predict ions are also made of two secondary maxima, the first between June and August, 1958, and the second in October, 1959. D.R.Barbe

523.7

7661. VISUAL DETERMINATIONS OF ASCENDING VELOCITIES IN SOME ERUPTIVE SOLAR PROMINENCES. K.Bjerke.
Ark. Astron., Vol. 2, Paper 13, 145-52 (1957).

Observations, made with a birefringent filter having a bandwid of 1.0 A in H_α, of heights above the (well-defined) photosphere give height–time curves from which velocity components along the sola radius are found. Two of the six curves are essentially straight lines and two approximately exponential. One velocity seems to ha exceeded 1000 km/sec. G.A.Chisna

523.7

7662. THE FLARE-SURGE EVENT.
R.G.Giovanelli and M.K.McCabe.
Austral. J. Phys., Vol. 11, No. 2, 191-200 (June, 1958).

Studies of flare-surges recorded on low magnification Hα flar patrol films show that dark surges on the disk come directly from flares, the initial direction of motion being almost invariably away from the nearest large sunspot. The basic feature of the event is the emission of a substantially continuous particle stream having different appearances at different stages. The first trace is usual the ejection from the flare of diffuse matter, brighter than the chromosphere, which fades and disappears by becoming transpare though it can be detected if the stream crosses the limb. The da surge subsequently appears at the base of the stream, close to the flare. Dark surges, bright streamers on the disk, and ejected flar seem to be closely related phenomena. It is shown that dark surg

an develop only if the temperature is decreasing, while in ejected lares whose brightness increases during flight the temperature nust be increasing. A.

523.877

663. THE VARIATIONAL METHOD FOR PROBLEMS OF ADIATIVE TRANSFER. NON-COHERENT FORMATION OF AN BSORPTION LINE IN THE MILNE–EDDINGTON MODEL.
.Ueno.
.R. Acad. Sci. (Paris), Vol. 246, No. 25, 3415-17 (June 23, 1958).
n French.

Huang's method (Abstr. 3838/1953) is adapted to the case of on-coherent diffusion and a simple explicit formula for the profile s obtained. No numerical calculations are made.

R.A.Newing

525.3 : 531.51

GRAVITATIONAL TORQUE ON A SATELLITE VEHICLE.
See Abstr. 6682

529.78 : 621.317.39

7664. COMPARISON OF CAESIUM FREQUENCY STANDARDS OF DIFFERENT CONSTRUCTION. L.Essen, J.V.L.Parry, J.H.Holloway, W.A.Mainberger, F.H.Reder and G.M.R.Winkler.
Nature (London), Vol. 181, 41-2 (July 12, 1958).

Comparisons between the National Physical Laboratory standard and an "Atomichron" by means of standard frequency transmission and time signals, having indicated average differences of 4 and 9 parts in 10^{10} respectively, direct comparisons were made at Teddington. Differences of about 4 parts in 10^{10} were found, due in part to different electronic systems. A.H.Cook

PHYSICS

53.081 : 539.18

665. FUNDAMENTAL CONSTANTS OF PHYSICS.
.R.Cohen, K.M.Crowe and J.W.M.Dumond.
lew York: Interscience Publishers (1957) 287 pp.
Review in: Trans Faraday Soc., Vol. 54, 1254-6 (Aug., 1958).

53.088

666. ON THE STATISTICAL-GRAPHICAL EVALUATION OF ESULTS OF MEASUREMENTS. W.Ehrenburg.
, angew. Phys., Vol. 9, No. 3, 147-51 (March, 1958). In German.

This paper describes the use of graphs of cumulative distribtion functions plotted on probability (normal law) graph paper, ith special reference to (1) estimation of standard deviation, 2) dissection into two, or more, normal distributions, and 3) finding normalizing transformations. There is also a theoretical iscussion of methods of estimating probabilities.

N.L.Johnson

FUNDAMENTALS

530.12

667. SOME REMARKS ON THE CLOCK PARADOX.
).Bergmann.
.cta phys. Austriaca, Vol. 11, No. 3, 377-89 (1957). In German.

The remarks include a comparison, within the framework of eneral relativity, of the time indicated by a clock executing small scillations about the origin with that indicated by a clock at rest at ne origin. Consideration is also given to the case in which the two locks are electrically charged, one clock moving around the origin nder the influence of a uniform magnetic field. A new definition or an ideal, electrically charged clock is also considered.

R.A.Newing

530.12

668. SHOULD RELATIVITY THEORY BE REVISED?
.Palacios.
n. Real Soc. Españ. Fís. Quím., Vol. 53(A), No. 1-2, 31-42 Jan.-Feb., 1957). In Spanish.

Several explanations of the "clock paradox" are criticized and, s they do not seem satisfactory, the author suggests to replace the quations of Lorentz by other equations which, being in agreement ith the principle of Galileo and with the invariance of the velocity f the light, do not lead to the mentioned paradox. The new equations ave the same physical consequences as the theory of Einstein, but ne value of the constant of Planck is no more invariant. Instead, it nanges, when measured in a moving frame, in such a way that the ed shift of the canal rays and the anomalous half-life of rapid uons are at once explained. A.

530.12

669. QUADRATIC LAGRANGIANS AND GENERAL RELATIVITY. G.Stephenson.
Nuovo Cimento, Vol. 9, No. 2, 263-9 (July 16, 1958).

Quadratic invariants of the Riemann–Christoffel curvature ensor and its contractions in a four-dimensional Riemann space are sed as the Lagrangians in three variational principles. The field quations are derived by treating the metric tensor and the arbitrary ymmetric affine connection as independent variables (following the method of Palatini), and specializing to the Christoffel connection after the variation. It is shown that the field equations derived from two of these variational principles in this way have as a class of solutions all solutions of Einstein's equations with cosmological term, whilst all three sets of field equations are satisfied by the Schwarzschild metric and have vanishing divergence. This suggests alternative forms of the field equations for gravitation, quadratic in the Riemann–Christoffel tensor and with zero trace, which give the same results for the three "crucial tests" of general relativity as Einstein's equations $R_{ik} = 0$. A.

530.12

7670. AN ANISOTROPIC COSMOLOGICAL SOLUTION IN GENERAL RELATIVITY. A.Raychaudhuri.
Proc. Phys. Soc., Vol. 72, Pt 2, 263-4 (Aug., 1958).

An anisotropic solution of Einstein's field equations extending through all space is obtained. As $|t| \to \infty$, the solution tends toward isotropy. G.Stephenson

530.12

7671. ON THE COMPATIBILITY OF THE FIELD EQUATIONS, THE CONSERVATION LAWS, AND THE EQUATIONS OF MOTION IN THE UNITARY FIELD THEORY. J.Pachner.
Ann. Phys. (Leipzig), Vol. 20, No. 7-8, 368-80 (1957). In German.

The question of the choice of the Hamiltonian is reviewed, and the unitary theory presented in a previous paper (Abstr. 8982/1957) is discussed. The general equations of motion of a test particle are derived and applied to the special cases of the Newton–Maxwell approximation and the static spherically symmetrical field.

W.A.Hepner

530.12

7672. TRANSLATORY MOTION AND DEFLECTION OF LIGHT IN A STATIC, SPHERICALLY SYMMETRICAL, UNITARY FIELD. J.Pachner.
Ann. Phys. (Leipzig), Folge 7, Vol. 1, No. 1-3, 110-15 (1958). In German.

The equations of motion derived in previous work (see preceding abstract) are integrated and the results of the special and the general theory of relativity are obtained as special cases. The effects due to the coupling of the gravitational and electric fields are too small to be detected in the cases considered. W.A.Hepner

530.12

7673. ON PERIODIC NON-SINGULAR SOLUTIONS IN THE GENERAL THEORY OF RELATIVITY. A.Papapetrou.
Ann. Phys. (Leipzig), Vol. 20, No. 7-8, 399-411 (1957). In German.

Using an approximation procedure, it is shown that there are no such non-trivial solutions representing a weak gravitational field throughout space. W.A.Hepner

530.12

7674. ON PERIODIC GRAVITATIONAL AND ELECTROMAGNETIC FIELDS IN THE GENERAL THEORY OF RELATIVITY. A.Papapetrou.
Ann. Phys. (Leipzig), Folge 7, Vol. 1, No. 4-5, 186-97 (1958). In German.

The considerations of a previous paper (see preceding abstract) are extended and applied to a combined gravitational and electromagnetic field. W.A.Hepner

530.12 : 523.112

7675. A NEW INTERPRETATION OF THE PROJECTIVE THEORY OF RELATIVITY AND APPLICATION TO A COSMOLOGICAL MODEL. E.Schmutzer.
Ann. Phys. (Leipzig), Fol. 7, Vol. 1, No. 1-3, 136-44 (1958). In German.

The generalized projective theory considered in a previous paper (Abstr. 4700/1958) is interpreted as describing the expansion of the universe. The value of the Hubble constant for a model with homogeneous mass distribution differs from the usual one.

W.A.Hepner

530.12 : 531.51

7676. STRONG GRAVITATIONAL WAVES IN VACUUM. A.S.Kompaneets.
Zh. éksper. teor. Fiz., Vol. 34, No. 4, 953-5 (1958). In Russian.

The results of Einstein and Rosen (J.Franklin Inst., Vol. 223, 43, 1937) are extended to the case of two interacting gravitational waves. A.

530.12 : 531.51

7677. BIRKHOFF'S GRAVITATIONAL FORCES IN PHYSICAL SPACE. C.Graef Fernández.
An. Inst. Fís., Vol. 1, 35-47 (1955). In Spanish.

530.12 : 531.51

7678. DERIVATION OF EXACT NON-LINEAR EQUATIONS OF MOTION FOR SINGLE PARTICLE ON BASIS OF BIRKHOFF THEORY. A.A.Borgardt.
Zh. éksper. teor. Fiz., Vol. 34, No. 6, 1632-3 (1958). In Russian.

Using the form of metric tensor proposed by Birkhoff et al. (Abstr. 488/1945) in their theory of gravitation, the non-linear Lagrangian for a single particle is formulated and the exact equations of motion derived from it by a variation principle.

J.W.Gardner

530.12 : 539.12

7679. TRANSFORMATION OF "SPIN DIRECTION" BY ORDINARY LORENTZ TRANSFORMATION. G.Ascoli.
Z. Phys., Vol. 150, No. 4, 407-8 (1958).

The transformation of the "spin direction" of a particle between two frames of reference is derived. As an application, the $\pi-\mu$ decay in flight is described in detail. M.J.Kearsley

530.12 : 530.145

SPECIAL THEORY OF RELATIVITY AND THE HYPOTHESIS OF CORPUSCULAR WAVES. See Abstr. 6657

530.145 : 530.12

7680. ADDENDUM TO THE VARIATIONAL PRINCIPLE FOR CLASSICAL FIELD THEORIES. J.Pachner.
Ann. Phys. (Leipzig), Folge 7, Vol. 1, No. 4-5, 201-2 (1958). In German.

Previous considerations (Abstr. 8982/1957) are supplemented by the statement that the functional dependence of the particle actions on the parameters of the particles is determined by the solution of the field equations. W.A.Hepner

530.145

7681. ASYMPTOTICAL BEHAVIOUR OF HIGHER GREEN FUNCTIONS. I.F.Ginzburg and D.V.Shirkov.
Nuovo Cimento, Vol. 8, No. 5, 773-4 (June 1, 1958).

Konuma and Umezawa's paper (Abstr. 1890/1957) is criticized. The present authors developed a general method for obtaining the different asymptotics, which reduces to a perturbation theory calculation to one order higher than indicated in the quoted paper. This shows that the results of those authors are correct only for the "symmetrical momentum" asymptotics. [The physically interesting asymptotics do not belong to that type]. An example is worked out.

P.Roman

530.145

7682. CAUSALITY CONDITION AND SPECTRAL REPRESENTATIONS OF THE GREEN'S FUNCTIONS. V.N.Gribov.
Zh. éksper. teor. Fiz., Vol. 34, No. 5, 1310-18 (1958). In Russian.

Spectral representations of the mean vacuum T-products of three Heisenberg operators were obtained with the aid of the causality condition in the form of the requirement of commutativity of the field operators on a space-like surface. The analytical properties of these functions in the complex plane are considered.

A.

530.145

7683. REMARKS ON THE INTRODUCTION OF THE THREE-DIMENSIONAL CHARGE-SPACE. F.Engelmann.
Z. Phys., Vol. 150, No. 4, 456-60 (1958). In German.

For real fields, the introduction of rotational symmetry in isotopic space is alone sufficient to give integral charges. On the other hand, for complex fields quantization of charge is an additional condition. The introduction of isotopic spin is inconsistent with a plus-quantization of Klein–Gordon fields.

L.Pincherl

530.14

7684. A CAUSAL THEORY FOR WAVES PROPAGATING WITH A VELOCITY GREATER THAN THAT OF LIGHT. H.Schmidt.
Z. Phys., Vol. 151, No. 4, 408-20 (1958). In German.

For the case of classical particles interacting with a scalar field it is shown that, although causality may be restored with the help of an absorbing envelope, as pictured by Wheeler and Feynman in the case of electrodynamics (Abstr. 733/1946; 3752/1950), covariance is thereby destroyed. W.A.Hepner

530.145 : 535.1

7685. LOCALIZATION OF A QUANTIZED FIELD AND ITS FLUCTUATIONS. C.M.Kotin.
An. Acad. Brasil Ciênc., Vol. 27, No. 4, 395-403 (1955).

It is shown that if the number of photons is undetermined, it is possible to construct a quantized field such that its average value coincides with a given classical electromagnetic field. Further, if the number of photons is specified, it is still possible to introduce an associated quantized field which corresponds in a certain sense to the classical one, describing the propagation of the photon. Finally, the fluctuations of the energy density and their correlation are calculated, showing that, as expected, the photon cannot be regarded as a point particle. P.Roma

530.1

7686. ON THE UNIVERSAL FERMI INTERACTION. S.A.Bludma
Nuovo Cimento, Vol. 9, No. 3, 433-45 (Aug. 1, 1958).

The parity-non-conserving, V-A form of Fermi interaction is derived from a principle of invariance under a continuous group of transformations, in analogy with the ordinary gauge-invariance derivation of the minimal electromagnetic interaction of charged particles. This assumption is a stronger restriction on the form o Fermi interactions than that invoked by Sudarshan and Marshak, Gell-Mann and Feynman, and Sakurai, and leads to additional predi tions that are subject to experimental check. If these transformati were symmetry transformations of the entire Lagrangian, then the β- and μ-decay coupling constants would be precisely equal. The implications of extending this Fermi gauge invariance to a group depending on space-time functions is discussed. The possibility th Fermi interactions involving change of strangeness are unallowed considered, and the results of assuming a universal Yukawa V-A parity-non-conserving interaction are tabulated. Such a Yukawa interaction, involving one new coupling constant, leads to reasonab K-meson and hyperon decay rates and allows π-meson decay into $\mu + \nu$ without any appreciable decay into $e + \nu$.

530.1

7687. PAIR EFFECTS IN THE LEE MODEL. J.S.Goldstein.
Nuovo Cimento, Vol. 9, No. 3, 504-18 (Aug. 1, 1958).

The Lee model of an exactly soluble, renormalizable field theory is extended by allowing the meson to make nucleon pairs, introducing a new nucleon field for the purpose. The theory is stil exactly soluble, with the following results; logarithmic divergence remain in the theory after renormalization, and the ghost state is shifted from the V-particle spectrum to the meson spectrum.

530.1

7688. CAUSALITY, COMPLEMENTARITY AND S-MATRIX FORMALISM IN 4 NON-LOCAL RELATIVISTIC THEORIES OF FIELDS. G.Wataghin.
Nuovo Cimento, Vol. 9, No. 3, 519-23 (Aug. 1, 1958).

A relativistic Lee-model of interacting fields is discussed and the formalism of the proposed non-local theory is illustrated on this example. A general formulation of the causality and complem entarity in non-local theories of fields is attempted.

530.1

7689. CONJECTURE CONCERNING THE PROPERTIES OF NONRENORMALIZABLE FIELD THEORIES. P.J.Redmond and J.L.Uretsky.
Phys. Rev. Letters, Vol. 1, No. 4, 147-8 (Aug. 15, 1958).

By exhibiting the properties of a model it is conjectured that all field theories yield functions which are singular for $g^2 = 0$, and it seems reasonable to surmise that the difference between renorm alizable and non-renormalizable theories is that only the former

mit asymptotic expansions; but it is possible in both theories to ain spectral density functions which yield finite propagators.
P.Roman

530.145 : 530.19

0. ON POLARIZATION OF RADIATION EMITTED BY A PER-OPTICAL" MAGNETIC MOMENT.
M.Loskutov and A.B.Kukanov.
éksper. teor. Fiz., Vol. 34, No. 2, 477-82 (1958). In Russian.
Polarization of radiation emitted by a "super-optical" magnetic nent moving in a ferroelectric is studied by methods of quantum ctrodynamics. The fraction of radiation involving spin-flip = −1) after emission of the photon, as well as that not involving -flip (ss' = +1) were determined. It is shown that the radiation omposed of two parts: a polarized component (which vanishes at threshold cos θ = 1) and an unpolarized component (which does vanish at the threshold). The unpolarized component is accom-ied by spin-flip. Energy losses are treated by classical methods the losses are separated into Cherenkov and collision losses.
A.

530.145

1. A CLASSIFICATION OF THE VARIOUS TERMS IN WEAK ERACTIONS. W.R.Theis.
Phys., Vol. 150, No. 5, 590-2 (1958). In German.
A theory of weak Fermi interactions is set up by describing the icles by two component spinor fields satisfying the Klein–don equation. Interactions are classified according to the number erivatives occurring in them. The zero-order interaction is of se the same as in the Feynman–Gell-Mann theory (Abstr. /1958). In the first (and in any odd) order one gets terms which ot conserve lepton number.
P.Roman

530.145 : 539.12

DECAYS OF THE μ MESON IN THE INTERMEDIATE-MESON EORY. See Abstr. 7260

530.145 : 539.12

CONSEQUENCES OF A PSEUDOVECTOR PION–NUCLEON UPLING AND THE UNIVERSAL β-DECAY. See Abstr. 7270

530.145

2. BHABHA'S EQUATION FIELD. F.E.Prieto C.
Inst. Fís., Vol. 1, 95-101 (1955). In Spanish.
Deals with Bhabha's equation for a particle with two mass and n states (Abstr. 56/1950, 1445/1952).

530.145

3. ON THE CONSTRUCTION OF QUANTUM FIELD THEORY THOUT LAGRANGE FORMALISM. W.Weidlich.
ovo Cimento, Vol. 9, No. 2, 228-48 (July 16, 1958). In German.
It is investigated to what extent the quantum theory of element-particles can be built up by using the following principle only: here exists an irreducible representation of the algebra of crea-n and annihilation operators a^+, a, and the infinitesimal transform-ons of the inhomogeneous Lorentz group can be constructed out hem". The representation of the inhomogeneous Lorentz group then be split up in irreducible ones classified by Wigner and cribing different sorts of elementary particles. Space-time dep-ence of all operators is introduced by a unitary transformation he a^+, a. Energy-momentum tensors and charge-current vectors found without use of fields. Fields and field equations, corres-ding to the various sorts of elementary particles, may also be up but are dispensable. Interactions are introduced as unitary nsformations of the a^+, a, mixing the irreducible representations he Lorentz group. This corresponds to in general non-local eraction terms in the Lagrange formalism.
A.

530.145

4. REPRESENTATION OF THE ISOBARIC SPIN OF RTICLES WITH STRONG INTERACTIONS. D.Ruelle.
lear Phys., Vol. 7, No. 5, 443-50 (July [2], 1958). In French.
The behaviour of all known particles in isobaric spin space is resented by 2 × 2 matrices or "quaternions". In particular an spin-zero particle introduced by d'Espagnat and Prentki and others appears from the Lagrangian of the strong interactions as a con-uence of invariance under charge conjugation. This representa-n gives a simple form to the isospin, charge and isofermion mber as infinitesimal operators. Although not irreducible when y rotations in isospin space and charge-conserving gauge trans-mations are considered, it may prove useful in the study of very ong or weak interactions.
A.

530.145

7695. POSSIBLE CONNECTION BETWEEN STRANGENESS AND PARITY. F.Gürsey.
Phys. Rev. Letters, Vol. 1, No. 3, 98-100 (Aug. 1, 1958).
It is shown that the idea of Yang and Tiomno, of considering four kinds of spinors with respect to their behaviour under space reflection, may provide a generalization of the parity operation for the baryons as $P = P_R\gamma_4$ where P_R is a modified isobaric parity operator. Here it is assumed that fields with hypercharge belong to the "imaginary", and those without one, to the "real" parity classes. This scheme leads one to assign opposite parities to Λ and Σ and to N and Ξ, as well as to K and $\bar{K}$.
P.Roman

530.145

7696. NUCLEON STRUCTURE AND PION-PHENOMENA.
D.Ito, S.Minami and H.Tanaka.
Nuovo Cimento, Vol. 9, No. 2, 208-27 (July 16, 1958).
The effect of nucleon structure is discussed correlating phenomenologically a variety of pion–nucleon phenomena with the nucleon core. In the high energy region, experimental evidence is interpreted in terms of nucleon structure. The main results are: (1) The optical radius R of the proton estimated from the π^-–p elastic scattering is nearly constant in the energy region (1-5) GeV. (2) The effective collision parameter in the π^-–p reaction shows the nearly constant value 0.8×10^{13} cm in the (1-5) GeV region. (3) The mean energy of the mesons produced in the π^+–p reaction in the energy range (1-5) GeV indicates a picture of meson production as a shaking off of mesons from the nucleon core. (4) In the nucleon–nucleon collision in GeV order, the mean energy of the produced mesons suggests a shaking off of the external meson cloud such as given by the isobar model. (5) A regularity of the reduced multiplicity is discussed concerning the proton–antiproton annihilation star. In the low energy region, the well-known failure of the meson theory on the S wave is to be ascribed to the internal effect of the nucleon structure.
A.

530.145

7697. ON THE ANALYTIC BEHAVIOUR OF THE EIGENVALUE OF THE S-MATRIX IN THE COMPLEX PLANE OF THE ENERGY.
T.Regge.
Nuovo Cimento, Vol. 9, No. 2, 295-302 (July 16, 1958).
A study on the analytic behaviour of the eigenvalues of the S-matrix in the complex plane of the energy $E = k^2$ is carried out for the case of spinless non-relativistic particles scattered by a fixed centre of force. A method is developed capable of finding in a finite number of steps any false zero or singularity of the eigenvalues of the S-matrix. The same method shows that in the upper k-plane Jost's f(k) function may have not only simple poles but also any kind of singularity. The method enables the main features of these singular points to be established.
A.

530.145

7698. A NOTE ON AN ACAUSALITY TEST. II.
D.Ito, S.Minami and H.Tanaka.
Nuovo Cimento, Vol. 9, No. 3, 461-9 (Aug. 1, 1958).
For Pt I, see Abstr. 5648 (1958). The forward scattering amplitude M(ω) (real part D(ω), imaginary part A(ω)) in pion–nucleon scattering is discussed when the acausal spread of the current commutator over the space-like interval is very small. If the acausal smearing is so small as to justify the treating of its effect as a perturbation, the errors of the dispersion relations are proved to be energy independent in the first order approximation. Hence, there would be no guarantee of affecting micro-causality even if the dispersion relations written, as they are, in a form of subtraction $D(\omega)-D(\mu)$ could be in agreement with the experiment.
A.

530.145

7699. CONSTRUCTION OF POTENTIALS FROM RESONANCE PARAMETERS. T.Regge.
Nuovo Cimento, Vol. 9, No. 3, 491-503 (Aug. 1, 1958).
Gel'fand and Levitan's procedure for the construction of a potential from the spectral measure function is simplified and made practical. Several theorems of purely mathematical character are also proved and their bearing on concrete problems exhibited.
A.

530.145

7700. DETERMINATION OF THE GROUND STATE OF A SYSTEM OF PARTICLES. C.Bloch.
Nuclear Phys., Vol. 7, No. 5, 451-8 (July [2], 1958). In French.
The linked diagram expansions of the ground-state energy and wave-function of a system of particles are derived by a method

involving the use of the time-dependent as well as the time-independent formulations of perturbation theory. The essential step is the derivation, in the time-dependent formulation, of a simple exponential formula obtained by summation of the disconnected vacuum–vacuum diagrams. A.

530.145 : 530.162

7701. DERIVATION OF THE GIBBS POTENTIAL OF A QUANTUM SYSTEM CONSISTING OF A LARGE NUMBER OF PARTICLES. C.Bloch and C.de Dominicis.
Nuclear Phys., Vol. 7, No. 5, 459-79 (July [2], 1958). In French.

The Gibbs potential is expressed as an expansion in terms of linked diagrams. In the limit of zero temperature, it reduces to the Goldstone expansion for the ground-state energy. At a finite temperature, the only difference with the latter comes from temperature dependent weight factors associated with every line of the diagrams. For a fermion particle (hole) line, the weight factor is given by the probability of the corresponding state being empty (occupied) in the independent particle gas at the given temperature. The general case of a system of interacting bosons and fermions is treated. Wick's theorem has been extended to the expectation value of a product of operators for a system of independent particles at a given temperature. A.

530.145

7702. MODIFIED PLANE WAVES AND REARRANGEMENT COLLISIONS. M.N.Hack.
Phys. Rev., Vol. 108, No. 6, 1636-41 (Dec. 15, 1957).

The use of modified plane waves as initial- or final-state basis vectors in the calculation of transition amplitudes for scattering problems is justified in a general manner by time-dependent and time-independent methods. Expressions for the S matrix in terms of modified plane waves are derived for rearrangement collisions. An equivalence theorem is obtained, by means of which the S matrix can be expressed in a variety of alternative forms. A.

530.145

7703. VARIATIONAL METHODS BASED ON THE DENSITY MATRIX. N.H.March and W.H.Young.
Proc. Phys. Soc., Vol. 72, Pt 2, 182-92 (Aug., 1958).

A method of setting up variational density matrices for many-particle problems which satisfy the necessary subsidiary conditions is discussed, and some explicit variational forms are presented. Each variational matrix is defined essentially in terms of the density matrix for a known problem, for example a system of free particles in a box, using either stationary wave or progressive wave solutions. The latter form is shown, by suitable transformation along lines suggested by earlier work of Macke (Abstr. 93, 938/1956), to lead very directly to a method intimately connected with that proposed by von Weizsäcker, and a completely quantum-mechanical variational basis for this method is thereby provided. One- and three-dimensional cases for particles moving in a common potential are considered explicitly, and ways of achieving greater accuracy than is possible with von Weizsäcker's scheme are clear, expecially in the three-dimensional case. A simple example is worked out in order to compare the results obtained from the various approximate variational forms with the exact density matrix for a linear harmonic oscillator potential, and the results are encouraging. A.

530.145

7704. REFINEMENT OF THE APPROXIMATION FOR SMALL ANGLES IN MULTIPLE-SCATTERING PROBLEMS. T.A.Germogenova.
Zh. éksper. teor. Fiz., Vol. 33, No. 4(10), 1067-9 (1957). In Russian.
English translation in: Soviet Physics — JETP (New York), Vol. 6, No. 4, 823-5 (April, 1958).

The numerical method of Spencer (Abstr. 3783/1953), for the integration of the propagation equation for the particle density, is extended to larger angles. G.H.Burkhardt

530.145 : 530.162

7705. ON SPACE–TIME CORRELATION FUNCTIONS FOR A SYSTEM OF PARTICLES WITH MAGNETIC INTERACTION. Yu.L.Klimontovich.
Zh. éksper. teor. Fiz., Vol. 34, No. 1, 173-85 (1958). In Russian.

A closed set of equations is obtained for the random functions $N_{q\,p}(t)$, which determines the number of particles at a given point q, p in phase space at time t and also for the vector and scalar potentials A, φ. By averaging, chains of recurrent equations for the moments of the random functions were obtained from this set of equations. The equations are solved under the assumption that the random process in the system is stationary and homogeneous. Expressions are obtained which permit one to determine space–time correlation functions of currents, densities and vector potentials fr a knowledge of equilibrium correlation functions. Expressions are obtained for correlation functions of random electromagnetic field strengths and currents. In the absence of space dispersion these formulae go over to the formulae derived by Leontovich and Rytov within the framework of the phenomenological theory. An explicit expression was obtained for the complex dielectric constant of the medium.

530.14

7706. THEORY OF SCATTERING OF PARTICLES BY NUCLEI. A.F.Grashin.
Zh. éksper. teor. Fiz., Vol. 34, No. 1, 251-3 (1958). In Russian.

If the nucleus is viewed as a Fermi sea, then the effect of the Pauli principle on the scattering of an incident particle can be take into account by multiplying the cross-section for collision with a nucleon by a factor F. This factor is given here as a function of momentum and mass of the incident particle. G.E.Brow

530.14

7707. SCATTERING OF PARTICLES WITH ARBITRARY SPINS. L.D.Puzikov.
Zh. éksper. teor. Fiz., Vol. 34, No. 4, 947-52 (1958). In Russian.

Geometrical consequences regarding scattering which follow from the fact that nuclear particles possess spins are considered i the present paper. A scattering matrix for a particle with an arbit rary spin is constructed. Quantities which can be experimentally measured, such as cross-section, polarization, correlation of pola izations etc., are expressed in terms of this matrix. It is examine to what extent the polarization experiment is sufficient, and it is shown that in order to reconstruct the scattering matrix one must either measure the scattering cross-section of a polarized beam or a polarized target or the polarization correlation after scattering (the initial state being an unpolarized one) or else, the change in polarization of the incident particles occurring during scattering (multiple scattering); the latter experiments will suffice if the spin of the beam is not smaller than that of the target. A

530.14

7708. ON SYMMETRY OF THE COORDINATE WAVE-FUNCTION OF A MANY-ELECTRON SYSTEM. Yu.N.Demkov.
Zh. éksper. teor. Fiz., Vol. 34, No. 3, 714-16 (1958). In Russian.

The relation between the two main methods of construction of the wave-function of a many-electron system, the group theory method and the Fock method, is considered. It is shown that the coordinate wave-function obtained by the first method satisfies Fock's conditions of cyclic symmetry.

530.14

7709. SCATTERING BY A SCHWARZSCHILD FIELD IN QUANTUM THEORY. N.V.Mitskevich.
Zh. éksper. teor. Fiz., Vol. 34, No. 6, 1656-8 (1958). In Russian.

The scattering cross-sections for scalar and spinorial particles, photons and gravitons by a weak static and spherically symmetric gravitational field are calculated. For vanishing rest-mass and small angles the cross-sections turn out to be identical. P.Roma

530.1

7710. ON A SIMPLIFICATION OF SOMMERFELD'S POLYNOMIAL METHOD. W.Nowak and T.Tietz.
Ann. Phys. (Leipzig), Folge 7, Vol. 1, No. 4-5, 296-8 (1958). In German.

It is shown that in some simple cases (harmonic oscillator, hydrogen atom, Wigner potential for S-states) the Schrödinger equation can be reduced to a type treated by Brenke (Bulletin of the American Mathematical Society, Vol. 36, 77, 1930). W.A.Hepn

530.145 : 539.1

7711. ROTATIONAL PROPERTIES OF THE TWO-DIMENSIONA ANISOTROPIC HARMONIC OSCILLATOR. II. THE COLLECTIVE-INTRINSIC DESCRIPTION. H.J.Lipkin and S.Goldstein.
Nuclear Phys., Vol. 7, No. 2, 184-94 (June [2], 1958).

For Pt I see Abstr. 4758/1958. Harmonic oscillator wave-functions are examined from the point of view of the collective rotational motion characteristic of the unified nuclear model. An oscillatory collective rotation is defined. Conditions are formulat for the separability of this motion from the other degrees of freedom of the system. Separability is demonstrated to good approximation in systems of large numbers of particles with large deformations.

530.145 : 539.19

712. ADIABATIC SECOND-ORDER ENERGY DERIVATIVES IN UANTUM MECHANICS. W.B.Brown.
roc. Cambridge Phil. Soc., Vol. 54, Pt 2, 251-7 (April, 1958).

The general equation for the adiabatic second-order derivative the energy E_n of an eigenstate with respect to parameters λ and occurring in the Hamiltonian H is

$$\frac{\partial^2 E_n}{\partial\lambda\partial\lambda'} = \left(\frac{\partial^2 H}{\partial\lambda\partial\lambda'}\right)_{nn} + 2\sum_{m\neq n}\frac{(\partial H/\partial\lambda)_{nm}(\partial H/\partial\lambda')_{mn}}{E_n - E_m}.$$

he applications of the equation to molecules (λ,λ' = nuclear osition coordinates) and to enclosed assemblies of interacting rticles ($\lambda = \lambda'$ = volume) are discussed, and the classical analogue r a micro-canonical ensemble is derived. A.

530.145

713. GROUP-THEORETICAL ANALYSIS OF THE FOUNDATIONS F RELATIVISTIC QUANTUM MECHANICS. IV. SPACE EFLECTIONS IN QUANTUM THEORY. Yu.M.Shirokov.
h. éksper. teor. Fiz., Vol. 34, No. 3, 717-24 (1958). In Russian.

The problem of invariance of relativistic quantum theory with espect to space reflections is investigated from the most general roup-theoretical viewpoint without making a concrete choice of the quations of motion. A complete classification is obtained of all nitary and non-unitary irreducible representations of the improper homogeneous Lorentz group. In considering the problem of rious parity representations use is made of the concept of a niversal covering group which permits one to prove rigorously the mpossibility of simultaneous existence of spinor particles, the ave-functions of which transform over various types of repre-ntations. An analysis is performed of Wu's experiment (Abstr. 593/1957) which is currently interpreted as a proof of non-conserv-tion of parity in weak interactions (Abstr. 3956, 5596/1957). From e group-theoretical viewpoint developed here experiments of the pe carried out by Wu and Lederman do not contradict conservation parity but merely conservation of charge conjugation and hence ove that charge is a pseudoscalar and the electromagnetic potential a pseudovector. A.

530.145

714. ON THE QUESTION OF SYMMETRY OF MANY-ELECTRON CHRÖDINGER WAVE-FUNCTIONS. E.D.Trifonov.
h. éksper. teor. Fiz., Vol. 34, No. 6, 1643-4 (1958). In Russian.

It is proved that Fock's symmetry conditions are necessary nd sufficient to ensure that a wave-function is such that it trans-orms under the permutation of its arguments according to an irre-ucible representation of the symmetrical group. P.Roman

530.145

715. ON THE QUANTUM MECHANICS OF A FORCE-FREE ARTICLE. M.Born and W.Ludwig.
. Phys., Vol. 150, No. 1, 106-17 (1958). In German.

Using a method evolved by P.P.Ewald in the theory of lattice otentials (Ann. Phys., Vol. 64, 253, 1921), an exact expression for he Schrödinger solution of the one-dimensional problem of the free notion and reflection of a Gaussian wave-packet is obtained with the elp of a θ-transformation. For finite times the amplitude is the um of two terms which, in the limiting cases of very small times nd very large times, reduce respectively to a pure particle repres-ntation and a pure wave representation. W.A.Hepner

530.145

716. NOTE ON RELATIVISTIC COULOMB WAVE FUNCTIONS. .D.Jackson, S.B.Treiman and H.W.Wyld, Jr.
. Phys., Vol. 150, No. 5, 640-7 (1958).

Some results on the wave functions of a Dirac particle in a oint charge Coulomb field are presented. Angular momentum and arity eigenfunctions are tabulated and used to construct solutions epresenting asymptotically a plane wave plus incoming or outgoing pherical waves. The solutions for $r \to 0$ are exhibited in a form losely similar to the corresponding free particle spinors and are sed to construct generalizations of the Casimir projection operators or positive or negative energy particles. The various wave functions resented are useful in calculations such as nuclear beta-decay in hich it is necessary to take into account final (or initial) state oulomb interactions. Because of the similarity of the wave-functions o those of a free particle, calculations including rigorously all oulomb corrections for such processes as allowed beta-decay can e performed with little more effort than is involved in a calculation sing only plane waves. A.

530.145 : 539.18

SOME COMMENTS ON PERTURBATION THEORY. See Abstr. 7422

530.162

7717. A THEORY OF CERTAINTY. III. BASIC IDEAS ON APPLICATION OF HEISENBERG'S INDETERMINACY PRINCIPLE. M.Castañs Camargo.
An. Real Soc. Españ. Fís. Quím., Vol. 53(A), No. 5-6, 101-8 (May-June, 1957). In Spanish.

For Pt II, see Abstr. 4148 (1956). Uncertainty is defined adequately as twice the uncertainty index obtained in Pt II. The application of the new index permits an unification of the theoretical and theoretico-experimental criteria and leads to:

$$\Delta q.\,\Delta p \geq h$$

for the Heisenberg's inequality. A.

530.162

7718. THE H THEOREM FOR THE DENSITY MATRIX. J.Philippot.
Bull. Acad. Roy. Belgique Cl. Sci., Vol. 44, No. 3, 240-3 (1958). In French.

The equations of irreversible evolution given by Prigogine and Toda (Abstr. 2805/1958) are employed to derive an H theorem extended to the non-diagonal elements of von Neumann's matrix. P.M.Davidson

530.162

7719. CLUSTER VARIATION METHOD OF COOPERATIVE PHENOMENA AND ITS GENERALIZATION. I. T.Morita.
J. Phys. Soc. Japan, Vol. 12, No. 7, 753-5 (July, 1957).

The cluster variation method of approximation for cooperative phenomena in a lattice system is generalized so as to be applicable to cases where the range of the interaction is long compared to the distance of neighbouring (lattice) points. A.

530.162

7720. CLUSTER VARIATION METHOD OF COOPERATIVE PHENOMENA AND ITS GENERALIZATION. II. QUANTUM STATISTICS. T.Morita.
J. Phys. Soc. Japan, Vol. 12, No. 10, 1060-3 (Oct., 1957).

The formulation of the cluster variation method of approximation for cooperative phenomena is generalized to cases where quantum statistics are taken into account. In this generalization, the nature of the approximation becomes more obscure, but the quantum counterparts of the various approximations introduced in classical statistics are easily found. The method in its lowest approximation — the point approximation — is applied to the lattice model of liquid helium proposed by Matsubara and Matsuda and found to lead to the same results as they obtained under the consideration of the analogy to an anisotropic spin system. A.

530.162

7721. ON CALCULATION OF COORDINATE PROBABILITIES BY GIBBS' METHOD. V.B.Magalinskiĭ and Ya.P.Terletskiĭ.
Zh. éksper. teor. Fiz., Vol. 34, No. 3, 729-34 (1958). In Russian.

Gibbs' statistical method is used to derive general formula which permits one to fully determine the stationary probability density as well as the transition probability density in a non-stationary process for an arbitrary generalized coordinate, provided the behaviour of the mean value of the latter is known in the presence (or after turning on) of additional forces acting in the direction of this coordinate. A.

530.162

7722. EVALUATION OF THE DENSITY MATRICES FOR HOMOGENEOUS SYSTEMS IN THERMAL EQUILIBRIUM. L.Saroléa and H.Koppe.
Z. Phys., Vol. 151, No. 4, 385-95 (1958). In French.

This is an investigation of the quantum mechanical n-molecule density matrices (ρ_n) for an assembly in thermal equilibrium. It is shown that there is an infinite system of differential equations connecting ρ_n, ρ_{n+1} and ρ_{n+2}. A number of results are obtained on the approximate solution of such equations. They are applied to the case of non-interacting particles and it is shown that there is a non-trivial, two-molecule correlation for such assemblies of order 1/N, which is essential for obtaining the Fermi–Dirac distribution. R.O.Davies

MECHANICAL MEASUREMENTS

531.717.1 : 621.317.49

7723. SWEPT FREQUENCY EDDY-CURRENT DEVICE TO MEASURE OVERLAY THICKNESS. E.A.Hanysz.
Rev. sci. Instrum., Vol. 29, No. 5, 411-15 (May, 1958).

An instrument is described which enables nondestructive measurements to be made of film and overlay thicknesses. It utilizes the change in electrical impedance of a composite sample resulting from differences in the thickness of the material being measured to cut-off a swept-frequency oscillator at a frequency determined by that thickness. Operating frequencies from 200 kc/s to 20 Mc/s have been used with frequency-sweep widths, or deviations, up to 10% to measure overlay thicknesses ranging from 0.000 05 to 0.007 in. on composite samples in which the conductivity-to-permeability ratio of the base and overlay differ by at least a factor of two. Equations are developed to illustrate the conditions for which a reactance-tube oscillator is employed in a unique manner to make the measurement automatic. A.

531.754.1

7724. A PLUMMET BALANCE FOR MEASURING THE SIZE DISTRIBUTION OF SOIL PARTICLES. T.J.Marshall.
Austral. J. appl. Sci., Vol. 7, No. 2, 142-7 (June, 1956).

A simple balance is described for use with a plummet in measuring the density of soil suspensions. The only manipulation required is to adjust for depth of immersion of the plummet. The percentage of soil in suspension at a given depth and time is read on a scale by means of a pointer. Suitable calibration procedures are given and some factors affecting the measurements are discussed. A.

MECHANICS OF FLUIDS

532.13 : 539.501

AN ATTEMPT TO GENERALIZE ONSAGER'S PRINCIPLE, AND ITS SIGNIFICANCE FOR RHEOLOGICAL PROBLEMS.
See Abstr. 7569

532.133

7725. NEW METHOD FOR MEASURING THE TWO RELAXATION TIMES OF A VISCOELASTIC LIQUID. Ali Abdel Kerim Ibrahim.
J. chem. Phys., Vol. 28, No. 6, 1264-5 (June, 1958).

A calculation based on the observations of Oldroyd, Strawbridge and Toms on a solution of polymethylmethacrylate in pyridine, agreeing with the interpretation of those authors (Abstr. 3359/1951). J.G.Oldroyd

532.137

7726. EXPERIMENTAL AND THEORETICAL INVESTIGATIONS ON THE OSCILLATING CYLINDER VISCOMETER FOR NON-ELASTIC LIQUIDS.
Ali Abdel Kerim Ibrahim and Abdel Monem I. Kabiel.
J. Phys. Soc. Japan, Vol. 12, No. 11, 1304-11 (Nov., 1957).

A new and exact theory of the oscillating cylinder viscometer is given for non-elastic liquids. By introducing into the final solution a dimensionless parameter defined by $\sqrt{2}\,Ba = x$, where the symbols have their usual significance and x may take any value, the following expression is obtained:

$$\left|\frac{\theta_0}{\phi_0}\right|^2 = \frac{A'n^4}{B' + C'n^2 + D'n^4},$$

where A', B', C' and D' are constants whose values depend on: (1) the density of the liquid under study; (2) the constants of the apparatus used; (3) the numerical value of x chosen. The theoretical curve representing the previous expression satisfies the experimental curve in one point (n_s, ϕ_s) at which they intersect. Hence, the value of η is determined by substituting the value of x chosen and the value of n_s obtained in the following equation

$$\eta = \frac{2\pi a^2}{x^2}\rho n_s .$$

Experiments were carried out on Shell motor oils (X-100-60, X-100-50, X-100-40), glycerine, castor oil, pump-oil, and paraffin oil. The results obtained confirm the validity of the theory and method. A.

532.137

7727. AN APPARATUS FOR THE VISCOMETRY OF ORGANIC LIQUIDS AT HIGH TEMPERATURE.
W.G.Burns, B.Morris and R.W.Wilkinson.
J. sci. Instrum., Vol. 35, No. 8, 291-3 (Aug., 1958).

The apparatus is suitable for operation at temperatures of up to 400°C. A sealed glass capillary viscometer is used so that oxygen can be excluded and measurements made above the normal boiling-point. The viscometer is immersed in a molten salt mixture contained in a welded tank and is viewed through special windows. These consist of Kodial polished glass disks sealed to Kovar cylinders. A rotation arrangement enables the viscometer to be inverted. Examples are given of its uses on known materials and on the effect of irradiation of para-terphenyl. A.

532.14

7728. THE USE OF A MANOMETRIC DENSITOMETER FOR MOLTEN SALTS. L.J.B.Husband.
J. sci. Instrum., Vol. 35, No. 8, 300-1 (Aug., 1958).

A manometric method of determining the density of a liquid is described. After calibration of the densitometer only remote observations need be made of a setting to a fiducial line and of the pressure of an applied gas. No confining fluid is used. This makes the densitometer particularly suitable for liquids at high temperatures. The densities of the following inorganic salts above their melting points have been found; sodium nitrite, potassium thiocyanate and potassium chlorate. A

532.5 : 533.6 : 536.7

7729. ON MULTIPLICITY THEOREMS AND AN EXACT SOLUTION IN DIABATIC FLOW. I.
W.A.Gustafson and M.Z.v.Krzywoblocki.
Acta phys. Austriaca, Vol. 11, No. 2, 131-46 (1957).

The concept is developed of the multiplicity of diabatic flows having the same streamline pattern, which yields a "substitution principle" and the associated canonical equations. This concept is then broadened by constructing two other substitution principles which relate diabatic flows having similar streamline patterns. A one-parameter family of exact solutions of the diabatic flow equations is presented in terms of the usual variables; this family behaves according to a polytropic law. It is shown that the canonical system of equations furnishes the identical family of flows. A

532.5 :533.6 : 536.7

7730. ON MULTIPLICITY THEOREMS AND AN EXACT SOLUTION IN DIABATIC FLOW. II.
W.A.Gustafson and M.Z.v.Krzywoblocki.
Acta phys. Austriaca, Vol. 11, No. 3, 294-320 (1957).

For Pt I, see preceding abstract.

532.5 : 533.6 : 536.7 : 530.14

7731. ON SOME ASPECTS OF DIABATIC FLOW AND GENERAL INTERPRETATION OF THE WAVE MECHANICS FUNDAMENTAL EQUATION. M.Z.v.Krzywoblocki.
Acta phys. Austriaca, Vol. 12, No. 1, 60-9 (1958).

Menger furnished a correct mathematical interpretation of the first law of thermodynamics using the notion of Stieltjes' integral. This interpretation is developed further and applied to a diabatic flow. The following items are considered: existence of the total differential of the heat input function; inverse problems; the form of the energy equation and the generalized interpretation of the fundamental equation of the wave mechanics. A

532.517.2

7732. ON THE PROBLEM OF THE STABILITY OF POISEUILLE FLOW. T.Sexl and K.Spielberg.
Acta phys. Austriaca, Vol. 12, No. 1, 9-28 (1958). In German.

A critical account of previous mathematical analysis of the conditions under which laminar flow in a circular pipe can break down, with some added refinements. J.G.Oldroyd

532.517.3 : 532.5

7733. TURBULENCE AND THE GROWTH OF WAVES.
K.Schuster.
Ann. Phys. (Leipzig), Vol. 20, No. 7-8, 381-5 (1957). In German.

Transverse acoustic disturbances of a laminar stream of fluid of kinematic viscosity ν, flowing with uniform speed U between plane parallel walls 2d apart, are discussed in relation to the Navier—Stokes equations. For certain modes of disturbance the amplitude of the oscillation increases exponentially, instead of decaying, and by combining these modes in such a way as to

form a stationary wave, a formula is obtained for a predicted critical value R_k of the Reynolds number $2Ud/\nu$ at which one would expect laminar flow to give way to turbulence. For water in a channel 1 cm wide, R_k = 19 400. J.G.Oldroyd

532.517.4

7734. ON THE SPECTRUM OF TURBULENCE. D.G.Wentzel. Phys. of Fluids, Vol. 1, No. 3, 213-14 (May-June, 1958).

The spectrum of turbulence on Chandrasekhar's theory (Abstr. 4863/1957) is derived. A.

532.525

7735. THE SHAPE OF THE JET WHEN AIR STREAMS INTO LOW PRESSURE CHAMBERS. E.Schrüfer. Z. angew. Phys., Vol. 9, No. 2, 88-95 (Feb., 1957). In German.

Apparatus is described for studying the pressure distribution inside a low pressure gas chamber when air is allowed to stream into it through orifices of different shape. The distributions are shown graphically and are illustrated by high frequency gas discharge photographs. Fluctuating pressures occur behind cylindrical orifices, but these disappear when the mean free path in the gas is comparable with the diameter of the orifice; a Knudsen number of 0.01 may be used in calculating the critical condition. H.J.H.Starks

532.528 : 534.234

ACOUSTICALLY INDUCED CAVITATION. See Abstr. 6769

532.584 : 537.565

7736. MOTION AND ACCUMULATION OF IONS AND OTHER SUSPENDED PARTICLES IN TURBULENT FLOWS. F.Wenk. Z. angew. Math. Phys., Vol. 9b, No. 5-6, 710-20 (1958). In German.

Theoretical computations of the paths of suspended particles in turbulent flows, both for constant and varying fields of force, are carried out. J.Dutton

532.612.4

7737. ON THE THEORY OF THE SURFACE TENSION OF LIQUID METALS. P.S.Zyryanov. Fiz. Metallov i Metallovedenie, Vol. 5, No. 3, 545-7 (1957). In Russian.

Frenkel's electrical double layer model of a metal surface is modified to take account of thermal mobility of surface ions. Hence are obtained values for the variation of surface tension with temperature. Agreement with experiment is, in general, good. A.F.Brown

532.612.4

7738. SURFACE TENSION OF FUSED ALKALINE EARTH METAL HALIDES. R.B.Ellis, J.E.Smith and E.B.Baker. J. phys. Chem., Vol. 62, No. 6, 766 (June, 1958).

Surface tension of several alkaline earth metal halides at temperatures ranging from near the melting points up to about 1000°C was determined. A.

532.612.4 :541.135

7739. LIMITING LAWS FOR SURFACE TENSION OF SOLUTIONS OF STRONG ELECTROLYTES. V.E.Bravina. Zh. éksper. teor. Fiz., Vol. 33, No. 4(10), 1065-7 (1957). In Russian. English translation in: Soviet Physics — JETP (New York), Vol. 6, No. 4, 822-3 (April, 1958).

A limiting law for the change in surface tension brought about by the addition of strong multivalent electrolytes of the asymmetrical type to a solvent medium is derived. It is considered that the electrical neutrality of each volume element is destroyed in the surface layer of the multivalent ions. For mono-monovalent electrolytes the law reduces to that of Onsager and Samaras (Abstr. 4067/1934). The influence of the dielectric constant of the solvent is considered and not assumed to be zero. W.Good

532.62 : 536.423.1

7740. SPHERICAL BUBBLE GROWTH. G.Birkhoff, R.S.Margulies and W.A.Horning. Phys. of Fluids, Vol. 1, No. 3, 201-4 (May-June, 1958).

Plesset and Zwick (Abstr. 2663/1952, Abstr. 5541/1954, Abstr. 5913/1955) have calculated the rate of growth of vapour bubbles in slightly superheated steam under constant external pressure. Their calculation assumes that the temperature drop is localized in a thin "boundary layer" near the bubble wall; the predicted bubble radius $R(t)$ is asymptotically proportional to $t^{1/2}$ when R is large enough for surface tension to be negligible. An analysis of this asymptotic phase is given below, which avoids the above "boundary layer" assumption, and contains that part of the analysis of Plesset and Zwick dealing with this phase as a limiting case. The analysis is shown to be (approximately) applicable also to gas bubbles in super-saturated liquids. A.

532.64.08 : 535.822.17

MEASUREMENT OF ANGLE OF CONTACT USING AN INTERFERENCE MICROSCOPE. See Abstr. 6899

532.66

7741. FLOW OF NOBLE GASES AT LOW PRESSURES THROUGH POROUS MEDIA AND CAPILLARIES. L.M.Lund and A.S.Berman. J. chem. Phys., Vol. 28, No. 2, 363-4 (Feb., 1958).

Experimental evidence is given for the gas and temperature dependence and insensitivity to changes in average pore radius between 1 and 200 μ of the dimensionless transmission probability parameter as the pressure approaches zero. This is interpreted to indicate a gas—wall interaction. R.Schnurmann

MOLECULAR THEORY OF LIQUIDS

532.7 : 534.22

7742. PROPERTIES OF MATTER. THE LIQUID STATE. T.Litovitz. J. Acoust. Soc. Amer., Vol. 30, No. 5, 383-4 (May, 1958).

Paper read at the Acoustical Society of America symposium on "unsolved problems in acoustics", October 1957, referring to (a) the problem of structural relaxation in liquids and the use of sound energy to disturb the distribution and energy states of molecules, particularly with respect to the liquid lattice; (b) the inadequate theory of structural relaxation and the impossibility of measuring excess absorption and velocity dispersion due to relaxation in liquids of simple structure until much higher frequencies are possible; and (c) a comparison of the dielectric and acoustical relaxation times for long chain molecules with hydroxyl groups bonded to C atoms. H.D.Parbrook

532.7 : 537.531 : 539.26

7743. THE THEORY OF X-RAY DISTRIBUTION CURVES OF FLUIDS AND AMORPHOUS MATERIALS. G.Voigtlaender-Tetzner. Z. Phys., Vol. 150, No. 2, 215-30 (1958). In German.

A one-dimensional model is used, in which the atoms have statistically defined displacements from given positions (cf. Abstr. 6739/1957), and its Fourier transform is obtained. This model can be made to simulate a solid crystal or a liquid or a gas. A.R.Stokes

532.7 : 534.22

THE VELOCITY OF SOUND IN LIQUIDS. See Abstr. 6736

532.712 : 537.363

7744. ELECTROPHORETIC ELECTROOSMOTIC PRESSURE. I.Levin. J. chem. Phys., Vol. 29, No. 1, 239-40 (July, 1958).

The effects of electrophoresis and electroosmosis are combined in one electrophysical cell to yield a hydrostatic pressure which begins (after a period of several hours) to develop on the completion of the formation of a semipermeable membrane on a filter paper diaphragm. An experiment with the cell and corn starch suspended in water is described. W.Good

532.72

7745. SELF-DIFFUSION OF LIQUIDS AT THE FREEZING POINT. J.D.Mackenzie and W.B.Hillig. J. chem. Phys., Vol. 28, No. 6, 1259-60 (June, 1958).

Theoretical estimates of the diffusion coefficient of liquids at the melting point are made by combining Andrade's expression for viscosity with the Einstein relation between viscosity and diffusion. Comparison with experiment shows that satisfactory and indeed remarkable agreement is obtained for metals (Na, Hg, Sn, In, Ga), provided that the ionic radius is used in the theory. Results for selected non-metals (A, CCl_4, H_2O, S_8, C_6H_6) are much less satisfactory. R.O.Davies

532.72

7746. INVESTIGATION OF THE DIFFUSION OF WATER VAPOUR IN HIGH BOILING POINT LIQUIDS. F.Gross. Z. angew. Phys., Vol. 9, No. 12, 606-12 (Dec., 1957). In German.

Describes experiments on Shell oil K8 and paraffin oil, both in the presence of the vapour alone and also when an inert gas is present at 20°C. The diffusion coefficients found are rather less than for Frenkel's hole model, but in much better agreement than with calculations based on Eyring's formula. J.M.Hough

532.72 : 537.323

THERMOELECTRIC EFFECTS ACCOMPANYING THERMAL DIFFUSION IN AQUEOUS SOLUTIONS. See Abstr. 7044

532.77

7747. THE STRUCTURE OF MOLTEN Au–Sn COMPOUNDS. A.F.Skrýshevskýĭ.
Ukrayin. fiz. Zh., Vol. 2, No. 4, 363-8 (1957). In Ukrainian with summaries (½ p. each) in Russian and English.

Gives the results of an X-ray study of molten liquid metal alloys Au–Sn, Au–Sn_2, Au–Sn_4, the electron distribution functions being determined. The liquid alloys are found to have their own characteristic structures, the atom separations being practically the same as in the crystal lattice, i.e. melting is not accompanied by any notable short distance change. C.R.S.Manders

532.77

7748. THEORETICAL AND EXPERIMENTAL RELAXATION TIMES OF SOLUTIONS. R.J.Meakins.
Proc. Phys. Soc., Vol. 72, Pt 2, 283-6 (Aug., 1958).

A comparison is made between these times for a number of solutes in benzene and in decalin, the theoretical times being evaluated from the equations of both Hill (Abstr. 3439/1954) and Debye. The agreement with Hill's equation is much better. W.Good

532.783

7749. ON THE PROBLEM OF THE STATE OF ORDER, ON ROTATION, OF A SPECIMEN OF A CRYSTALLINE LIQUID, ORIENTATED IN A MAGNETIC FIELD. H.Lippmann.
Ann. Phys. (Leipzig), Folge 7, Vol. 1, No. 1-3, 157-64 (1958). In German.

The nuclear magnetic resonance line shape of protons was studied in a sample of p-azoxyanisol rotated about an axis perpendicular to the magnetic field direction. The fine structure of the line vanishes at a critical angular velocity associated with a change of ordering of the molecular clusters into cylindrically orientated layers. The dependence of the critical angular velocity on the magnetic field and viscosity is discussed. A.J.Manuel

MECHANICS OF GASES

533.275 : 621.317.39

7750. DETERMINATION OF WATER VAPOR FROM THE CHANGE IN ELECTRICAL RESISTANCE OF A HYDROSCOPIC FILM.
E.R.Weaver, E.E.Hughes and A.W.Diniak.
J. Res. Nat. Bur. Stand., Vol. 60, No. 5, 489-508 (May, 1958).

The electrical conductivity of a thin film of such a material as phosphoric acid changes over a wide range with changes in the concentration of water in the atmosphere with which it is in contact. By adjusting the pressures of a sample of gas of known composition and one of unknown composition, they can be made to have the same concentration of water (more accurately the same fugacity) shown by the production of equal resistance of the detecting film. Modification of the apparatus, procedures, and calculations described in an earlier publication are presented and numerous applications of the method are discussed. The method has the merits of simplicity, speed, and great sensitivity. Only small samples are needed, and few substances interfere. A.

533.51

7751. FRACTIONATION AND OUT-GASSING IN OIL DIFFUSION PUMPS. W.Bächler and H.G.Nöller.
Z. angew. Phys., Vol. 9, No. 12, 612-16 (Dec., 1957). In German.

An experimental investigation of the optimum combination of out-gassing and fractionation of the pump fluid. L.G.Carpenter

533.51

7752. PARTIAL PRESSURE ANALYSIS OF THE ULTIMATE PRESSURE OF OIL-DIFFUSION PUMPS WITH THE OMEGATRON. G. Reich and H.G. Nöller.
Z. angew. Phys., Vol. 9, No. 12, 617-21 (Dec., 1957). In German.

Describes experiments on the analysis of residual products obtained in apparatus evacuated by oil diffusion pumps, using an omegatron (a small and simple r.f. mass spectrometer). L.G.Carpenter

533.56

7753. THE DECOMPOSITION OF OILS IN DIFFUSION PUMPS. Ye.S.Borovýk, B.H.Lazaryev and N.M.Tsýn.
Ukrayin. fiz. Zh., Vol. 2, No. 1, 78-86 (1957). In Ukrainian.

The decomposition of D-1 oil, octoil, octoil-S, and glycerol under various working conditions was studied by low-pressure fractionation. All the decomposition products can apparently be frozen out at liquid nitrogen temperatures (–196°C), solid CO_2 cooled traps can remove the heavier products whilst freon cooled traps are not even effective in taking out the heaviest fraction. C.R.S.Manders

533.56

7754. IMPROVEMENT OF DIFFUSION PUMP CHARACTERISTICS BY USING LIQUID NITROGEN TRAPS.
Ye.S.Borovýk, B.H.Lazaryev, M.F.Fedorova and N.M.Tsýn.
Ukrayin. fiz. Zh., Vol. 2, No. 1, 87-94 (1957). In Ukrainian.

The ultimate vacuum of the pumps is largely determined by the presence of decomposition products. The construction is described of a trap with screens cooled by liquid nitrogen. With an M-1000 pump a vacuum of approximately 10^{-7} mm was obtained in less time than it took previously to achieve 10^{-6} mm of Hg. C.R.S.Manders

533.59

7755. ON THE ELECTRICAL "CLEAN UP" OF GASES IN THE HIGH-VACUUM PRESSURE RANGE. G.Strotzer.
Z. angew. Phys., Vol. 10, No. 5, 207-16 (May, 1958). In German.

The author reviews the literature of gas "clean-up" in high-vacuum systems and distinguishes three hypotheses for the mechanism. It is (a) a surface effect, (b) a volume effect, both depending on ion bombardment, (c) it is an effect depending on the presence of certain nuclei. The hypotheses are expressed in mathematical form, leading to a simple kinetic description of the phenomena. T.Mulvey

MOLECULAR THEORY OF GASES

533.7

7756. DETERMINATION OF RELATIVE PARTIAL PRESSURES FROM MASS SPECTROMETER ION INTENSITY MEASUREMENTS. T.A.Milne.
J. chem. Phys., Vol. 28, No. 4, 717-18 (April, 1958).

The relative efficiency of detection of different ionic species by a mass spectrometer can be determined by the use of a Knudsen cell with two regions at different temperatures. This enables relative partial pressures to be found. J.Hawgood

533.7

7757. MASS SPECTROMETER ANALYSIS OF THE VAPOR IN EQUILIBRIUM WITH THE ALKALI-METAL CHLORIDES. T.A.Milne, H.M.Klein and D.Cubicciotti.
J. chem. Phys., Vol. 28, No. 4, 718-19 (April, 1958).

Results of an investigation into the abundance of polymers in such vapours show that they are important, agreeing with Abstr. 1970 (1957) and disagreeing with predictions from infrared spectra in Abstr. 4151 and 8518 (1957). J.Hawgood

533.7 : 539.213

CALCULATION OF ATOMIC DISTRIBUTION CURVES FOR DIATOMIC AND POLYATOMIC GASES. See Abstr. 7527

VIBRATIONS. ACOUSTICS

534.131 : 537.228.1

7758. THE ELECTRICAL EQUIVALENT SCHEMES OF VIBRATING PIEZOELECTRIC CRYSTAL BARS. J.Tichý.
Ann. Phys. (Leipzig), (Folge 7), Vol. 1, No. 4-5, 219-31 (1958). In German.

Formulae are derived and tabulated for the electrical equivalent schemes of a piezoelectric bar in longitudinal, torsional and bending vibration. The influence of external and internal damping and of the air gap is taken into account. R.F.S.Hearmon

534.154 : 621.317.39

7759. PROPOSED MASSLESS REMOTE VIBRATION PICKUP. C.Stewart.
J. Acoust. Soc. Amer., Vol. 30, No. 7, 644-5 (July, 1958).

A method is proposed for the remote measurement of vibrations by detecting the frequency modulation in a microwave beam reflected by the vibrating surface. It offers the possibility of permitting rapid scanning for vibration patterns, of avoiding loading effects, and of

unusually wide band response. Rough calculations predict displacement sensitivities below a micron, from a system using a 20 mW klystron source. Also, soil impedance measurements appear possible with less than a milliwatt of driving power. A.

534.2

7760. THE DAMPING OF ELASTIC WAVES OF HIGH FREQUENCY IN SINGLE CRYSTALS OF A CUBIC FERROMAGNETIC MATERIAL. G.Simon.
Ann. Phys. (Leipzig), Folge 7, Vol. 1, No. 1-3, 23-35 (1958). In German.

The logarithmic decrement is calculated from the energy lost in unit time under conditions of saturation, and when the wavelength is comparable with the domain size and only 180° changes in the direction of magnetization can take place. The results are compared with those of Levy and Truell (Abstr. 8602/1953). J.E.Caffyn

534.2

7761. MOTION OF THE SURFACE OF A UNIFORM ELASTIC HALF-SPACE PRODUCED BY A BURIED PULSE.
C.H.Pekeris and H.Lifson.
J. Acoust. Soc. Amer., Vol. 29, No. 11, 1233-8 (Nov., 1957).

An exact solution is obtained for the motion of the surface of a uniform elastic half-space due to the application at a depth H below the surface of a concentrated vertical force. The time-variation of the applied force is assumed to be represented by the Heaviside unit function. The solution for the horizontal and vertical components of displacement is cast in the form of single integrals over a fixed range, and these were evaluated on the electronic computer of the Weizmann Institute (WEIZAC). The assumed source emits both S waves and P waves. Beyond a distance r_1 from the epicentre, which is equal to $H/\sqrt{2}$ in the case $\lambda = \mu$, the original S wave is converted on reaching the surface into a diffracted SP wave travelling along the surface. At large ranges, the SP phase is more pronounced than the P phase. The S phase is marked by a finite jump for $r < r_1$, and by a logarithmic infinity for $r > r_1$. The coefficient of the logarithmic term is zero both at $r = r_1$ and at large ranges, having a sharp maximum at $r = 1.004\, r_1$. There is no Rayleigh wave at $r < r_1$. At large ranges ($r/H \gg 1$) the solution, as a function of the reduced time $\tau = ct/R$, approaches the form of the solution for the surface pulse. A.

534.2

7762. DISPERSION CURVES FOR LONGITUDINAL AND FLEXURAL WAVES IN SOLID CIRCULAR CYLINDERS. E.A.Flinn.
J. appl. Phys., Vol. 29, No. 8, 1261-2 (Aug., 1958).

Two sets of curves in non-dimensional terms are given for the longitudinal and flexural wave group velocity as a function of period for different values of Poisson's ratio. The curves were calculated from the lowest mode longitudinal and flexural wave phase velocities given by Bancroft and Hudson respectively. H.J.H.Starks

534.2

7763. PLANE WAVES AT THE BOUNDARY OF A GYROTROPIC MEDIUM. M.A.Gintsburg.
Zh. éskper. teor. Fiz., Vol. 34, No. 6, 1635-7 (1958). In Russian.

Discusses the Fresnel surface wave for the case of an optically active medium. In general for a plane-polarized, incident plane wave the surface wave exhibits weak elliptical polarization.

J.W.Gardner

534.2 : 535.81

SCHLIEREN METHOD TO DETERMINE ELASTIC WAVE VELOCITY IN LIQUIDS AND SOLIDS. See Abstr. 6895

534.213

7764. CHARACTERISTIC VIBRATIONS OF GLASS RINGS.
L.Bergmann.
Z. Phys., Vol. 151, No. 1, 46-53 (1958). In German.

The characteristic elastic vibrations of glass rings can be rendered visible by observation in linearly or circularly polarized light. The apparatus for doing this is described and the method by which the ring is made to vibrate at frequencies in the range from 315 to 1800 kc/s discussed. A number of photographs are given which show clearly the results obtained. These photographs are compared with those obtained earlier (Abstr. 95/1950) for glass cylinders and the similarities discussed. The results are compared with those calculated from the theory of Airey (Archiv de Mathematik und Physik Vol. 20, 289, 1913) for radial vibrations and a satisfactory agreement found. H.G.Jerrard

534.22 : 532.7

7765. THE VELOCITY OF ULTRASONICS IN Sn–Bi LIQUID ALLOYS AND THEIR COMPRESSIBILITY.
I.G.Polotskiĭ and Z.L.Khodov.
Akust. Zh., Vol. 4, No. 2, 184-6 (1958). In Russian.

A study is made of the variation of velocity of ultrasonics with concentration and of variation of adiabatic compressibility, for eutectic and non-eutectic Sn–Bi alloys. On both sides of the eutectic the relation is linear, though the inclinations to the concentration axis differ. C.R.S.Manders

534.22 : 536.48

7766. THE VELOCITY OF SOUND IN A 2.7% He^3 – He^4 MIXTURE.
C.C.Lim, A.C.H.Hallett and E.W.Guptill.
Canad. J. Phys., Vol. 35, No. 11, 1343-4 (Nov. 1957).

The liquid was contained in a $BaTiO_3$ cylindrical tube and radial modes of vibration were excited. From the resonance frequencies and the radius of the tube, the velocity of sound was derived. In order to avoid the measurement of the radius at low temperatures the apparatus was calibrated with pure He^4. The velocity of sound in the mixture was obtained as a function of the temperature within the range from 1.1° to 2.4°K. At the same temperatures, the velocity of sound is smaller in the mixture than in He^4; otherwise the shapes of the temperature–velocity curves are very similar. Unlike He^4, the attenuation in the mixture became so large at 2.4° that the measurements could not be made at higher temperatures.

R.Eisenschitz

534.22

7767. THE DISPERSION OF ULTRASONIC WAVES IN AQUEOUS SOLUTIONS OF 2-2-VALENT ELECTROLYTES.
G.Schmid and H.Pessel.
Naturwissenschaften, Vol. 44, No. 8, 257-8 (1957). In German.

Dispersion curves are given for solutions of MgS_2O_3, $CuSO_4$, $MgSO_4$, $MnSO_4$ and $CoSO_4$ in the frequency range 0.35 to 15.75 Mc/s. With the exception of $MnSO_4$ only the upper parts of the dispersion curves can be realized. W.Good

534.22

7768. THE DISPERSION OF ULTRASONIC WAVES IN A SOLUTION OF POLYACRYLIC ACID IN WATER.
G.Schmid and H.Pessel.
Naturwissenschaften, Vol. 44, No. 8, 258 (1957). In German.

This and the absorption were examined in a 10% solution of the acid at 20 and 35°C for a frequency range 0.35 to 5.25 Mc/s. The ratio of the experimental to the classical absorption is less than 1. Relaxation frequency and total dispersion are evaluated.

W.Good

534.22 : 536.48

7769. PROPAGATION OF ORDINARY SOUND IN LIQUID HELIUM NEAR THE λ POINT. C.E.Chase.
Phys. of Fluids, Vol. 1, No. 3, 198-200 (May-June, 1958).

The velocity and attenuation of ordinary sound in liquid helium were measured at a frequency of 1 Mc/s in the neighbourhood of the λ point. By using measuring techniques of high resolution, it was possible to observe the behaviour in this region in considerable detail. The velocity passes through a minimum approximately 2×10^{-4} °K below the λ point; the maximum attenuation occurs about 8×10^{-5} °K below T_λ. Both velocity and attenuation behave in a manner characteristic of a relaxation process, with the relaxation time a rapid function of temperature near T_λ. The results below T_λ can be described with good quantitative accuracy if this relaxation time is given by

$$\tau = 8.8 \times 10^{-12}(T_\lambda - T)^{-1}.$$

Excess attenuation is also observed above the λ point; this cannot be explained by the above relaxation process. The experimental uncertainties are so large in helium I that no reliable conclusions can be reached, but there is some indication that the quantity α/ω^2 is not independent of frequency in this region. The behaviour of the velocity is considered with regard to the Ehrenfest relations, and it is shown that the discontinuity in isothermal compressibility which those relations predict must be almost entirely due to a discontinuity in γ. No contradiction of the Ehrenfest relations is implied, since present knowledge of γ suggests that a discontinuity of the required magnitude may indeed occur. A.

534.22 : 532.122

7770. VELOCITY OF SOUND AND THE COMPRESSIBILITY OF CONCENTRATED SOLUTIONS OF STRONG ELECTROLYTES.
I.G.Mikhaĭlov, L.I.Savina and G.N.Feofanov.
Vestnik Leningrad Univ. (1957), No. 22, Ser. Fiz. Khim., No. 4, 25-42. In Russian.

An ultrasonic interferometer was used to measure the velocity

of sound in strong aqueous solutions of some 14 common chemical compounds, e.g. KBr, KCl, KI, $NaNO_3$, NaCl, Na_2CO_3 etc. The experiments were carried out over the temperature range 0-90°C for various concentrations and the results are tabulated. For many of the solutions the maximum of the velocity v. temperature curve tends for higher concentrations to be displaced in the direction of lower temperatures. C.R.S.Manders

534.22 : 532.7

STRUCTURAL RELAXATION IN LIQUIDS. ACOUSTIC STUDY. See Abstr.7742

534.222.2

7771. DETONATION VELOCITY OF GASEOUS OZONE. A.G.Streng, C.S.Stokes and L.A.Streng.
J. chem. Phys., Vol. 29, No. 2, 458-9 (Aug., 1958).

This was measured for 100, 75, and 50 mole % of O_3 in O_2, using spaced phototubes timed by a crystal oscillator, and its limiting value was found to agree with the theoretical one of 1878 m/sec. Calculated detonation properties of liquid O_3 are given. P.Gray

534.222.2

7772. AN EXACT SOLUTION OF A SPHERICAL BLAST WAVE UNDER TERRESTRIAL CONDITIONS. G.D.Ray.
Proc. Nat. Inst. Sci. India A, Vol. 24, No. 2, 106-12 (1958).

An exact solution of the equations of one-dimensional motion of a gas representing a spherical wave of explosion headed by shock was obtained. The shock moves with constant velocity and advances in a quiescent atmosphere of constant pressure and density. The solution is applicable to both weak and strong shocks. A.

534.222.2

7773. STABILITY OF SHOCK WAVES IN RELATIVISTIC HYDRODYNAMICS. V.M.Kontorovich.
Zh. éksper. teor. Fiz., Vol. 34, No. 1, 186-94 (1958). In Russian.

Stability against small perturbations of the discontinuity surface is investigated for shock waves in an arbitrary medium described by relativistic equations for an ideal fluid. A.

534.222.2 : 539.19

THE DISSOCIATION OF A PURE DIATOMIC GAS BEHIND A STRONG NORMAL SHOCK WAVE. See Abstr. 7475

534.23

7774. THE PROBLEM OF ABSORPTION OF ULTRASONIC WAVES IN ETHYL ACETATE. I.G.Mikhailov.
Akust. Zh., Vol. 4, No. 2, 199-200 (1958). In Russian.

Two maxima are observed in the 3 to 30 Mc/s band for the $\alpha\lambda = f(\nu)$ curve of ethyl acetate (where α is the absorption coefficient, λ the wavelength, and ν the frequency). Assuming these maxima are due to relaxation the times (at a temperature of 20° C) are calculated and found to be 0.98×10^{-8} and 2.65×10^{-8} sec, respectively. C.R.S.Manders

534.23

7775. ABSORPTION OF ULTRASONIC WAVES IN ETHYL ACETATE. V.F.Nozdrev.
Akust. Zh., Vol. 4, No. 2, 202-4 (1958). In Russian.

From a survey of recent developments in this field the author concludes that there is some doubt about many of the measurements. It is stressed that there is urgent need for new methods of greater precision for work on ultrasonic absorption at lower frequencies. Also given is a preliminary note that, in the Molecular Acoustics Laboratory of the Moscow Regional Pedagogical Institute, work is proceeding on a multiple-radiator pulse-method which it is hoped will resolve the problem as to whether there is, or is not, a second relaxation region in acetates in the 1 to 10 Mc/s range. C.R.S.Manders

534.23

7776. MEGACYCLE ATTENUATION AND BORDONI PEAKS. N.G.Einspruch and R.Truell.
Phys. Rev., Vol. 109, No. 3, 652-3 (Feb. 1, 1958).

Results of Bordoni-peak measurements made at 10, 30 and 60 Mc/s in relatively impure deformed polycrystalline aluminium are compared with previous measurements at 5 Mc/s and 40 kc/s. The observed difference between the results of these measurements and those of previous measurements appears to depend on the purity of the material. A.

534.23 : 539.2

MAGNETIC EFFECTS IN THE ATTENUATION OF TRANSVERSE ACOUSTIC WAVES BY CONDUCTION ELECTRON TRANSPORT.

534.232 : 621.395.623.8

7777. METHODS OF GENERATING HIGH-INTENSITY SOUND WITH LOUDSPEAKERS FOR ENVIRONMENTAL TESTING OF ELECTRONIC COMPONENTS SUBJECTED TO JET AND MISSILE ENGINE NOISE. J.K.Hilliard and W.T.Fiala.
J. Acoust. Soc. Amer., Vol. 30, No. 6, 533-8 (June, 1958).

Discusses several methods for generating high-intensity sound in the laboratory. Typical characteristics for the two most promising methods — the plane wave tube and the reverberant box — are discussed. A simple formula for the reverberant box is derived. Measurements made on several sound generators commercially built are presented. A.

534.24 : 538.566

REFLECTION OF ACOUSTIC WAVES FROM A ROUGH SURFACE. See Abstr. 7213

534.26 : 548.733

7778. THE DIFFRACTION OF ULTRASONIC WAVES BY GRATINGS OF SOLID CYLINDERS IN MULTIPLE LAYERS. P. de Villers.
C.R. Acad. Sci. (Paris), Vol. 247, No. 1, 52-4 (July 7, 1958). In French.

Plane ultrasonic waves, of frequency 2.5 Mc/s and wavelength 0.57 mm, were diffracted in water by a grating made from rows of cylindrical shafts arranged in layers. The diameter of each shaft was 0.3 mm. The intention was to simulate X-ray diffraction by a crystal. The theory is discussed and experimental agreement with it was found. L.Mackinnon

534.26

7779. CONTRIBUTION TO THE STUDY OF THE SCATTERING OF A PLANE ULTRASONIC WAVE BY SURFACES OF PERIODIC STRUCTURE. H.Blons.
C.R. Acad. Sci. (Paris), Vol. 247, No. 1, 50-2 (July 7, 1958). In French.

Reflections from periodic surfaces of triangular, rectangular and semi-cylindrical (concave and convex) cross-section were studied in a water tank, using pulses of fixed carrier-frequencies between 0.625 and 2.5 Mc/s. The spacing of the reflection grating was from 1 to 4 mm. Good agreement was found with diffraction theory. In the case of the rectangular cross-section, the effect of the depth of the grooves was examined in theory and experiment, and agreement found for the angles of incidence producing no zero-order spectrum and thus good scattering. L.Mackinnon

534.321.9 : 623.983 : 621.396.965.4

7780. ELECTRONIC SECTOR SCANNING. D.G.Tucker, V.G.Welsby and R.Kendell.
J. Brit. Instn Radio Engrs, Vol. 18, No. 8, 465-84 (Aug., 1958).

A system of scanning, or swinging, the beam of an acoustic receiver by electronic means, while the transducer itself remains stationary, is described. The scanning may be very rapid, so that in a pulse echo-ranging system (e.g. asdic) the whole scanned sector may be covered within the duration of a pulse, giving effectively simultaneous reception over a sector which is shown to be approximately n times the 3 dB width of the beam itself, n being the number of sections into which the array is divided. The more critical details of the design are discussed, and experimental results given to confirm the theoretical analysis. A.

534.321.9 : 537.312.62 : 539.2

ULTRASONICS IN THE STUDY OF THE FUNDAMENTAL PROPERTIES OF SOLIDS. See Abstr. 7477

534.39 : 535.42

DIFFRACTION OF LIGHT ON ULTRASONIC WAVES OF LARGE AMPLITUDE. See Abstr. 6885

534.39 : 539.12

ULTRASONIC SATURATION OF NUCLEAR MAGNETIC ENERGY LEVELS. See Abstr. 7314

534.41 : 621.317.79

7781. THE DETECTION AND ANALYSIS OF INFRASOUNDS PROPAGATED IN THE AIR IN THE RANGE 2 TO 30 c/s. L.Pimonow.
Ann. Télécomm., Vol. 12, No. 12, 419-23 (Dec., 1957). In French.

Instruments to measure the sound pressure level and to analyse the spectrum of steady and transient infrasounds are described. H.D.Parbrook

534.7

PHYSIOLOGICAL ACOUSTICS. HEARING. See also under "Medical science. Human physiology". Decimal classification 612.85

534.78 : 621.391

7782. AUTOMATIC RECOGNITION OF PHONETIC PATTERNS IN SPEECH. H.Dudley and S.Balashek.

J. Acoust. Soc. Amer., Vol. 30, No. 8, 721-32 (Aug., 1958).

The mechanical recognition of ten spoken words (the digits) with near-perfect precision was demonstrated under laboratory conditions for a single talker after optimum circuit adjustment for his voice. Such word recognition points to the possibility of automatic voice writing and other voice-controlled operations. The device described is based on two principles — the recognition of sustainable patterns of power v. frequency in speech, and the recognition of the durations of such phonetic patterns in words. An alphabet of only ten patterns is proven adequate for limited word recognition, at least in the case of a single talker. The successful performance of the ten-word digit recognizer for voice dialling of telephone numbers was recorded on a motion picture film shown in the oral presentation. Data from the film are discussed here. This paper describes a working model of a phonetic pattern recognizer built at Bell Telephone Laboratories based on a detailed power-frequency spectrum analysis. Tests, to be discussed, indicate that this device, which supersedes an earlier model, leads to almost perfect digit recognition when set for a particular voice. The device also offers outstanding possibilities in speech transmission. The former application will be described in this paper and the latter in a companion paper (see following abstract). A.

534.78 : 621.391

7783. PHONETIC PATTERN RECOGNITION VOCODER FOR NARROW-BAND SPEECH TRANSMISSION. H.Dudley.
J. Acoust. Soc. Amer., Vol. 30, No. 8, 733-9 (Aug., 1958).

See preceding abstract. Syllabic spectral patterns of continuous speech have been classified into a finite alphabet through an automatic recognition process built into a "phonetic vocoder". The classified spectra were then used to synthesize corresponding sounds approximating the original phonetic content, within broad limits. The principle of phonetic recognition can be applied to realize a maximally efficient coding of speech, considering only the phonetic content. The corresponding frequency band is about 50 c/s, a 6-fold reduction over the frequency-band vocoder. Also, the recognition process assures that spoken words can be printed automatically as phonetic text. Speech processed with the phonetic vocoder described here was obtained using an alphabet of only four consonants and six vowels. Nonetheless, limited vocabulary transmission was demonstrated over a band of about 100 c/s indicating the feasibility of this coding method. Articulation figures of over 95% were measured using the spoken digits as test material. For a larger vocabulary of monosyllabic words, about 50% intelligibility was found in a limited test. Spectrograms of the vocoder input and output are compared. A.

534.839 : 621.317.39

7784. NOISE MEASUREMENT. E.Lübcke.
Frequenz, Vol. 12, No. 7, 209-13 (July, 1958). In German.

It is suggested that hitherto, in noise measurement, insufficient account has been taken of the greater subjective effects of the higher frequencies and that, accordingly, a linear correction of +3 dB/octave rising with frequency should be introduced. This proposal is based on such aural characteristics as threshold of pain, equal loudness curves and intelligibility of speech against a noisy background etc. Numerous relevant curves obtained by various workers are shown which, in general, support this proposal. The design of suitable noise meters, including analysers, is outlined. H.G.M.Spratt

534.843

7785. ON THE USE OF THE ITERATION METHOD IN ROOM ACOUSTICS. A.Moles.
Ann. Télécomm., Vol. 12, No. 12, 443-4 (Dec., 1957). In French.

This method, by successive re-recording of a passage of speech or music transmitted through a room from loudspeaker to microphone, emphasizes distortion in the system. The number of re-recordings required to make the signal unrecognizable may be an index of the overall acoustic quality of a room. The method also changes the relative proportions of semantic and aesthetic information in music. H.D.Parbrook

534.844

7786. SOUND AMPLIFICATION IN REVERBERANT SPACES. A.F.B.Nickson.
Austral. J. appl. Sci., Vol. 6, No. 4, 476-85 (Dec., 1955).

Consideration is given to the manner in which amplification may be used to the best advantage. Three instances where amplification improved the listening conditions are described and the results given in terms of the subjective impressions formed by the listener. It is concluded that for most Australian buildings the use of a directional loudspeaker system, such as a loudspeaker column, should produce improved listening. A method is given for determining the length and position of a column for any specific case. A.

OPTICS. RADIATION. SPECTRA

535.24

7787. SOME APPLICATIONS OF THE FOUR LUMINANCE FUNCTIONS OF THE BLACK BODY IN PRECISION PHOTOMETRY. F.Rotter.
Acta phys. Austriaca, Vol. 12, No. 1, 29-59 (1958). In German.

Four different analytical expressions are derived for the luminance of a full radiator in terms of its temperature. Two give very close approximations over the range from 2000° to 10 000°K, but are not very convenient for calculation. The other two are more convenient and accurate over the range from 1600° to about 5000°K. It is shown that the errors due to measurement by means of any receptor whose sensitivity curve differs from the V_λ curve can be evaluated if three standards of known colour temperatures are available. Formulae for the scotopic luminance of the full radiator are also given. The measurement of colour temperature is discussed and a method is described for determining the errors due to small departures from full radiation conditions. J.W.T.Walsh

535.242.43

7788. SOME NOTES ON THE MECHANISM OF FLICKER PHOTOMETERS. D.Vinci.
Atti Fond. Ronchi, Vol. 13, No. 3, 196-8 (May-June, 1958). In Italian.

Discusses the motor requirements for flicker photometers using a rotating sector disk. An a.c. motor is shown to have the best characteristics. R.W.Fish

535.317.1

7789. PERFECT CONCENTRIC SYSTEMS WITH AN OUTER SHELL OF CONSTANT REFRACTIVE INDEX. G.Toraldo di Francia and M.T.Zoli.
Atti Fond. Ronchi, Vol. 13, No. 3, 223-35 (May-June, 1958).

A class of perfect optical systems with spherical symmetry is considered, which consists of an outer shell with constant refractive index and a core with variable refractive index. Numerical computations have been carried out for a number of values of the refractive index of the outer shell. It turns out that the total variation of the refractive index within the core becomes very small when the refractive index of the shell has a high value. A.

535.321

7790. THE USE OF COARSE GRATINGS TO FIND THE REFRACTIVE INDEX OF LIQUIDS. G.M.Sreekantath and C.A.Verghese.
J. sci. Instrum., Vol. 35, No. 8, 305-6 (Aug., 1958).

An alternative method to that given in J. sci. Instrum., Vol. 34, 464 (Nov., 1957), which does not require measurements of band shift, is described. Two immiscible liquids A and B are used, with B filling the bottom half and A, the standard liquid (water at 25°C), the upper half of an optical cell. Two systems of bands are formed and the refractive index of B can be derived from the known value of the refractive index of A and the discrete angles of incidence for which the two systems coincide. Typical observations for CCl_4 are given. S.Weintroub

535.322

7791. TWO-COMPARTMENT HOLLOW PRISM. E.H.Melvin and D.Macmillan.
J. Opt. Soc. Amer., Vol. 48, No. 8, 581 (Aug., 1958).

Practical details of a stainless steel hollow prism are given. This has been successfully used to measure small differences of refractive index between a solvent and a solution. The prism may also be used to determine absolute indices. R.W.Fish

535.323 : 535.345

DISPERSION OF LIGHT IN CRYSTALS OF DIPHENYL AT 20.4°K. See Abstr. 6858

535.325 : 537.226.2

7792. THE BEHAVIOUR OF THE REFRACTIVE INDEX AND DIELECTRIC CONSTANT OF NH_3 IN THE REGION OF THE INVERSION SPECTRUM AT PRESSURES FROM 10^{-3} TO 1 TORR, WITH SPECIAL REFERENCE TO THE LINE J = 3, K = 3. H.Bayer.
Z. Phys., Vol. 149, No. 5, 550-70 (1957). In German.

Assuming the Weisskopf and van Vleck theory of collision broadening of spectral lines, an expression is deduced for the real part of the refractive index and the dielectric constant for a quantum

mechanical system. This treatment is applied to the inversion spectrum of NH_3 to describe the behaviour of refractive index and dielectric constant with temperature and pressure. Quantitative calculations are made in the case of the most intense line J = 3, K = 3. R.C.Seymour

535.33.03

7793. MEASUREMENT OF THE SPECTRAL DISTRIBUTION IN THE INFRARED REGION OF THE ULTRAVIOLET STANDARD. F.Rössler.
Ann. Phys. (Leipzig), Folge 7, Vol. 1, No. 1-3, 122-35 (1958). In German.

Measurements were made of the absolute intensities of emission of lines and continuous radiation in the region 1-8 μ, for a mercury lamp on which previous measurements had been made in the ultraviolet (Abstr. 5710/1952). G.F.Lothian

535.33.03

7794. INVESTIGATIONS ON LIGHT SOURCES FOR SPECTRAL ANALYSIS. XII. AN ELECTRONICALLY CONTROLLED PRECISION SPARK GENERATOR WITH 40 kV H.T. Á.Bardócz.
Z. angew. Phys., Vol. 9, No. 2, 82-8 (Feb., 1957). In German.

For previous work see Abstr. 2027 (1956). Describes in great detail an electronic system for providing controlled sparks for spectroscopic analysis. Time resolved spectra are shown for different points along the channel of a particular condensed spark. Reproducibility problems are discussed. J.D.Craggs

535.33.07

7795. THE GEOMETRIC WIDTH OF A SPECTRAL LINE. S.Guidarelli.
Atti Fond. Ronchi, Vol. 13, No. 3, 191-5 (May-June, 1958). In Italian.

Even in the case of monochromatic illumination, the geometric image of the entrance slit formed in a spectroscope will not be uniform, since the magnification depends on the angle of incidence of the rays at the prism or grating. The effect of this varying magnification is calculated, and it is shown to be negligible in many grating instruments, but is appreciable in prism systems. The additional width has to be added to that due to chromatic aberration or lack of monochromaticity. R.W.Fish

535.33.07

7796. AN ELECTRODE HOLDER FOR THE POROUS CUP TECHNIQUE OF SPECTROGRAPHIC ANALYSIS. G.W.J.Kingsbury and A.Fursey.
J. sci. Instrum., Vol. 35, No. 9, 350-1 (Sept., 1958).

Constructional details of a design that is "self aligning, corrosion resistant and quick in operation". G.F.Lothian

535.33.07

7797. A U.V. FILTER FOR THE 2537 A LINE. F.Dörr.
Naturwissenschaften, Vol. 44, No. 8, 256 (1957). In German.

Crossed polarizing films of polyvinyl alcohol and iodine give 15% maximum transmission and 270 A half-width. W.T.Welford

535.33.07 : 536.483

GLASS DEWARS FOR OPTICAL STUDIES AT LOW TEMPERATURES. See Abstr. 6926

535.331

7798. MAGNETIC RESONANCE IN OPTICALLY EXCITED ATOMIC STATES: SHARPENING OF THE LINES BY DOUBLE SCATTERING OF THE LIGHT. J.P.Barrat and J.Brossel.
C.R. Acad. Sci. (Paris), Vol. 246, No. 19, 2744-7 (May 12, 1958). In French.

The method of double resonance was applied to the 6^3P_1 level of Hg, using a procedure which permits the isolation of photons twice scattered by the Hg atoms. R.W.Nicholls

535.331

7799. THE EFFECTS ON THE VAPOUR PRESSURE OF MERCURY AND THE OSCILLATOR STRENGTH OF THE 2536.52A ($^1S_0$-$^3P_1$) RESONANCE LINE BY THE PRESENCE OF ARGON AT HIGH DENSITY. A.Michels, H.de Kluiver and D.Middelkoop.
Physica, Vol. 24, No. 6, 543-4 (1958).

The oscillator strength of the line was measured as a function of pressure in an especially designed absorption cell in which there were a constant number of mercury atoms in the light path. The oscillator strength rose slowly with pressure between zero and 500 amagat. R.W.Nicholls

535.331 : 539.18

THE SPECTRAL DETERMINATION OF THE ISOTOPIC COMPOSITION OF LEAD. See Abstr. 7430

535.331

7800. EXTREME ULTRAVIOLET SPECTRUM OF Mn III. M.A.Catalán.
An. Real Soc. Españ. Fís. Quím., Vol. 53(A), No. 9-10, 179-84 (Sept.-Oct., 1957). In Spanish.

A condensed spark discharge in vacuum between manganese electrodes was investigated for structural analysis of the spectra of Mn. The photographs were obtained with the vacuum grating spectrograph in Princeton University. Wavelengths ranging from 590 to 2450 A and estimated intensities are presented for 851 lines in the spectrum of Mn III. A.

535.331

7801. QUANTITATIVE MEASUREMENT OF THE CONTINUUM OF THE 3^3P SERIES LIMIT FOR Mg. W.Bötticher.
Z. Phys., Vol. 150, No. 3, 336-45 (1958). In German.

This continuum, which begins at 2514 A, is produced in emission under certain conditions (temperature and electron density). The absolute value of the coefficient of absorption K_ν at the series limit and the decrease of the continuum are determined. It is possible to use in this case with fair accuracy the Inglis–Teller rule dealing with the relationship between the principal quantum number of the last separately observable line of a series and the concentration of the perturbing particles. F.Lachman

535.331

7802. DOUBLE RESONANCE BY EXCITATION WITH HYPERFINE STRUCTURE COMPONENTS AND DETECTION BY SELF-ABSORPTION. H.Bucka.
Z. Phys., Vol. 151, No. 3, 328-39 (1958). In German.

A double-resonance method with self-absorption is used on the hyperfine structure multiplet of the $7^3P_{3/2}$ terms of the Cs I spectrum. The dependence of the signal on the self-absorption is investigated. For the $7^3P_{3/2}$ term a signal of lower intensity is found at 400.8 ± 1 Mc/s, attributed to the high frequency transition between hyperfine structure terms with F = 4 and F = 3. C.Turner

535.332 : 539.14

7803. THE ARC SPECTRUM OF IODINE AND THE QUADRUPOLE MOMENT OF I^{127}. K.Murakawa.
J. Phys. Soc. Japan, Vol. 13, No. 5, 484-92 (May, 1958).

The analysis of the arc spectrum of iodine is continued, and the identification of the term sequence $(^3P_2)nf$ is fairly well completed, and some other levels newly detected. From the hyperfine structure of $(^3P_2)7p^4D_{7/2}$ the quadrupole moment without shielding correction was found to be $Q'(I^{127}) = -0.63$ barn, whereas the value deduced from $(^3P)6s^4P_{5/2}$ previously was $Q'(I^{127}) = -0.71$ barn. The mean of these two values is $Q'(I^{127}) = -0.67 \pm 0.04$ barn. This is in agreement with the value $Q'(I^{127}) = -0.66$ barn that is deduced from the h.f.s. of the ground term $5p^{5\,2}P_{3/2}$ whose measurement is given in the literature. Assuming the shielding correction $\Delta = -0.07$, the true quadrupole moment $Q(I^{127}) = -0.62$ barn is obtained. A.

535.333 : 541.124

ORIGIN OF AFTERGLOWS IN MIXTURES OF NITROGEN AND OXYGEN. See Abstr. 7576

535.333

7804. OBSERVATION OF A NEW BAND SYSTEM OF IONIZED NITROGEN, N_2^+. J.Janin and J.d'Incan.
C.R. Acad. Sci. (Paris), Vol. 246, No. 25, 3436-9 (June 23, 1958). In French.

A new system, $^2\Pi_g - A\,^2\Pi_u$, was observed in a discharge excited by cm waves through a N_2–Ne mixture at about 3 mm pressure. The lower state is the upper state of the Meinel bands. A preliminary analysis yields the following constants in cm^{-1}:

$$T_e \sim 54250;$$
$$G_v = 839.5(v + \tfrac{1}{2}) - 12.75(v + \tfrac{1}{2})^2 + 0.116(v + \tfrac{1}{2})^3.$$

R.F.Barrow

535.333

7805. ELECTRONIC SPECTRA OF FREE RADICALS AT $4^\circ K$ — NH_2. G.W.Robinson and M.McCarty, Jr.
J. chem. Phys., Vol. 28, No. 2, 349-50 (Feb., 1958).

The radical was condensed at a concentration of about 1 : 25 in argon. The bands observed are displaced from the gas-phase bands to slightly shorter wavelengths. G.F.Lothian

535.33:

7806. ELECTRONIC SPECTRA OF FREE RADICALS AT $4^\circ K$ — HNO, NH AND OH. G.W.Robinson and M.McCarty, Jr.
J. chem. Phys., Vol. 28, No. 2, 350 (Feb., 1958).

These spectra are observed in the method of the preceding

abstract if H_2O is not eliminated. The magnitudes and directions of the shifts from the gas-phase bands are small but vary for the different bands. Identification of trapped free radicals by this method appears to be advantageous. G.F.Lothian

535.333

7807. ROTATIONAL ANALYSIS OF THE VISIBLE BANDS OF VANADIUM OXIDE. A.Lagerqvist and L.E.Selin.
Ark. Fys., Vol. 12, Paper 27, 553-68 (1957). In German.

Details of the analysis are given (see also Abstr. 4517/1955). It has not been possible to identify the transition, which may be quartet—doublet. The upper state is perturbed by several states, for which approximate values of B have been derived.

R.F.Barrow

535.333

7808. EMISSION SPECTRUM OF THE OH RADICAL IN AN OXYACETYLENE FLAME. F.P.Dickey and J.M.Hoffman.
J. chem. Phys., Vol. 28, No. 6, 1253 (June, 1958).

Recordings, between 10 and 23 μ, showing OH emission almost free from overlapping by H_2O were obtained by the phase-discrimination method; in this, the mechanical radiation chopper is replaced by a 13 c/s variation in acetylene flow rate. A.G.Gaydon

535.338.334

7809. ON THE BROADENING OF HYDROGEN LINES BY THE FIELD OF ELECTRONS. H.Van Regemorter.
C.R. Acad. Sci. (Paris), Vol. 246, No. 19, 2737-40 (May 12, 1958). In French.

The theory of Kolb is applied to the Balmer lines where Pannekoek's approximation is valid. The new distribution function is calculated as is also the absorption coefficient.

R.W.Nicholls

535.338.334

7810. PRESSURE SHIFT AND BROADENING IN THE RESONANCE LINE OF CALCIUM. W.R.Hindmarsh.
Proc. Phys. Soc., Vol. 72, Pt 2, 279-81 (Aug., 1958).

The profile of the 4227A line was determined in absorption by the vapour at 600°C in He, using a plane grating Littrow spectrograph in the sixth order (focal length 12 m, dispersion 7 mm/A). A hyperfine structure component of Cd 5086A in the fifth order served as reference line. Changing the He pressure from 6 to 75 cm gave a line shift of +0.0062 cm^{-1}, while the half-intensity pressure width of the absorption coefficient was 0.224 cm^{-1}. For the r^{-6} type of interaction between colliding atoms the expected broadening is 0.27 cm^{-1}, but for the observed width the Lindholm—Foley theory predicts a shift of 0.074 cm^{-1}. S.T.Henderson

535.34

7811. DESCRIPTIVE APPROACH TO THE MECHANISM OF THE EFFECTS OF SOLVENT ON THE INFRARED SPECTRA OF VIBRATION. L.Galatry.
C.R. Acad. Sci. (Paris), Vol. 246, No. 25, 3442-5 (June 23, 1958). In French.

The influence of molecular interaction on the vibrational frequencies of substances in solution is theoretically discussed in general terms. G.I.W.Llewelyn

535.34.03 : 621.373.4

7812. DESIGN AND APPLICATION OF A FREQUENCY STANDARD FOR A MICROWAVE SPECTROMETER. H.G.Fitzky.
Z. angew. Phys., Vol. 10, No. 7, 297-303 (July, 1958). In German.

The design is described in detail and demonstrated by means of wiring diagrams. This frequency standard enables frequencies up to 25 kMc/s or more to be measured with an accuracy of $< 10^{-7}$. It is also possible to stabilize the frequencies of klystrons so as to maintain them constant within $< 10^{-8}$ over fairly long periods of time.

F.Lachman

535.34.07

7813. BARIUM FLUORIDE ABSORPTION CELLS FOR SPECTROSCOPY. J.M.Gordon.
J. Opt. Soc. Amer., Vol. 48, No. 8, 583 (Aug., 1958).

Sealed liquid absorption cells with barium fluoride windows transparent from 0.2 to 15μ have been successfully used without deterioration. G.I.W.Llewelyn

535.343

7814. ABSORPTION SPECTRUM OF THE NITROSONIUM ION. T.A.Turney and G.A.Wright.
J. chem. Phys., Vol. 29, No. 1, 252 (July, 1958).

A single, intense, broad band at 260 mμ, obtained in the absorption spectrum of a dilute solution of sodium nitrite in concentrated perchloric acid, is attributed to the nitrosonium ion. It is confirmed that this band originates from a charge transfer transition.

G.I.W.Llewelyn

535.343

7815. ULTRAVIOLET AND INFRARED ABSORPTION SPECTRA OF 4-METHOXYPYRIDINIUM SALT. H.Tsubomura.
J. chem. Phys., Vol. 28, No. 2, 355-6 (Feb., 1958).

From observations of the spectra of 2,6-dimethyl-4-methoxypyridine (DMP) and related compounds it is concluded that the C—O bond in DMP cation has a large double bond character similar to that of the C—O bond in pyrone and pyridone. G.I.W.Llewelyn

535.343 : 535.337

7816. ZEEMAN EFFECT AND ANALYSIS OF THE SPECTRA OF TRIVALENT Sm IN MONOCRYSTALS OF DIFFERENT SYMMETRY. H.Lämmermann.
Z. Phys., Vol. 150, No. 5, 551-72 (1958). In German.

Presents the results of experimental work on absorption spectra of Sm^{3+} in $Sm(C_2H_5SO_4)_3.9H_2O$, $SmCl_3.6H_2O$ and $Sm(NO_3)_3.6H_2O$ in polarized light between 4.2 and 80°K, with high dispersion, in external magnetic fields of various intensity and direction. The crystal quantum numbers and J values are given for the fundamental and seven excitation terms. F.Lachman

535.343 : 537.312.5

ABSORPTION SPECTRUM OF HgI_2. See Abstr. 7013

535.343

7817. PARTIAL REVISION: ABSORPTION SPECTRUM AND QUANTUM STATES OF THE PRASEODYMIUM ION. I. SINGLE CRYSTALS OF PRASEODYMIUM CHLORIDE.
E.V.Sayre, K.M.Sancier and S.Freed.
J. chem. Phys., Vol. 29, No. 1, 242-3 (July, 1958).

The few disagreements between the authors' experimental data and the theoretical analysis of Judd (Abstr. 576/1958) on the absorption spectrum of anhydrous praseodymium chloride are discussed and found to be resolvable. G.I.W.Llewelyn

535.343 : 539.19

7818. MICROWAVE SPECTRUM OF BrCN AND DEPENDENCE OF QUADRUPOLE COUPLING CONSTANT ON THE VIBRATIONAL STATE. T.Oka and H.Hirakawa.
J. Phys. Soc. Japan, Vol. 12, No. 7, 820-3 (July, 1957).

The hyperfine structure of the J = 1 ← 0 and J = 2 ← 1 rotational transitions of BrCN were measured. Values of eqQ(Br^{79}) and eqQ(Br^{81}) for each vibrational state were obtained as follows

	Vibrational State (v_1,v_2,v_3)	From the frequencies of the J = 1 ← 0 transition	From the frequencies of the J = 2 ← 1 transition
eqQ(Br^{79}) in Mc/s	(0,0, 0)	685.6 ± 0.4	685.3 ± 0.8
	(1,0, 0)	687.9 ± 0.6	689.1 ± 0.7
	(0,2^0,0)	681.6 ± 0.7	680.2 ± 0.9
eqQ(Br^{81}) in Mc/s	(0,0, 0)	572.8 ± 0.2	572.7 ± 0.6
	(1,0, 0)	576.1 ± 0.9	574.2 ± 0.7
	(0,2^0,0)	568.9 ± 1.5	567.3 ± 1.5

The considerable increase of eqQ for the stretching vibration (v_1 = 1) is explained in terms of the decrease of the double bond character of the Br—C bond, and the decrease of eqQ for the excitation of the bending vibration (v_2 = 1) is ascribed to the variation of the z component of q tensor. A.

535.343

7819. THE MICROWAVE ROTATION SPECTRUM OF THE Tl (UNIVALENT) HALIDES. H.G.Fitzky.
Z. Phys., Vol. 151, No. 3, 351-64 (1958). In German.

The rotation constants of all the halides of all Tl isotopes were determined from the pure rotational spectra, and the nuclear distances and mass ratios were calculated from these data. The dipole moment of TlF and TlCl was obtained from the Stark effect. The nuclear quadrupole constants of the halogen nuclei and their quadrupole moment ratios follow from the hyperfine structure.

F.Lachman

535.343.9 : 535.375.5

7820. RAMAN SPECTRA OF H_2O AND D_2O AT VARIOUS TEMPERATURES. V.I.Val'kov and G.L.Maslenkova.
Vestnik Leningrad. Univ. (1957), No. 22, Ser. Fiz. Khim., No. 4, 8-13. In Russian.

Tables of measurements are given for O—H and O—D vibrations in light and heavy ice at various temperatures from 0°C down to −196°C. The authors interpret their results in terms of interactions of intramolecular and intermolecular vibrations.

C.R.S.Manders

535.343.9 : 535.375.5

7821. THE RAMAN SPECTRUM OF QUARTZ AND ITS INTERPRETATION. D.Krishnamurti.
Proc. Indian Acad. Sci. A, Vol. 47, No. 5, 276-91 (May, 1958).

The spectrum was photographed using Hg 2537 A with exposures up to 100 hours. 15 Raman lines are assigned to fundamental vibrations, including 4 weak lines which are forbidden; possible reasons for their appearance are discussed. 33 further lines are assigned to overtones and combinations. G.F.Lothian

535.343.9 : 535.375.5

7822. THE POLARIZATION OF ANOMALOUS FIRST ORDER RAMAN SCATTERING OF LIGHT IN CRYSTALS OF ALKALI-HALIDE COMPOUNDS. P.P.Pavinskiĭ.
Vestnik Leningrad Univ. (1957), No. 22, Ser. Fiz. Khim., No. 4, 51-61. In Russian.

Theoretical paper considering effects observed by Gross, Pavinskiĭ and Stekhanov (Abstr. 2361/1950). It is shown that the effect is satisfactorily explained by the scattering of light by a weakly bound electron, or hole, localized around an imperfection in the crystal. C.R.S.Manders

535.343.9 : 535.375.5

7823. INTERACTING EXTRA-MOLECULAR AND INTER-MOLECULAR OSCILLATIONS OF WATER MOLECULES IN THE GYPSUM CRYSTAL. A.I.Stekhanov.
Vestnik Leningrad Univ. (1957), No. 22, Ser. Fiz. Khim., No. 4, 62-9. In Russian.

Broad bands are found in the Raman spectrum of the gypsum crystal at 2200 and 4000 cm^{-1}. These are accounted for by interactions between internal and external oscillations of the water molecules of crystallization. C.R.S.Manders

535.343.9 : 535.375.5

7824. DEPENDENCE OF THE INTENSITY OF THE RAMAN LINES ON THE FREQUENCY OF THE EXCITING LIGHT IN THE RESONANCE REGION. P.Schorygin and L.Kruschinski.
Z. Phys., Vol. 150, No. 3, 332-5 (1958). In German.

When an exciting line ν_0 is near an absorption band (ν_1) of the test material, the Raman intensity is not only proportional to ν_0^4 but also to $(\nu_0^2 - \nu_1^2)^{-4}$; this relation is confirmed for measurements on five aromatic nitro-compounds. It fails when the exciting line lies within the absorption band. G.F.Lothian

535.345 : 535.325

7825. ABSORPTION AND REFRACTION OF AMMONIA AS A FUNCTION OF PRESSURE AT 6 mm WAVELENGTH.
F.W.Heineken and A.Battaglia.
Physica, Vol. 24, No. 7, 589-603 (July, 1958).

An apparatus is described to measure refractive indices and absorption coefficients of gases as a function of pressure up to one atmosphere at wavelengths of 12 and 6 mm. The method is based on the change in resonance frequency and quality factor Q of a cavity, filled with the gas of which the refraction and absorption are to be determined, compared to the resonance frequency and Q-value of a cavity filled with a reference gas (for example argon). The cavities are compared in a time interval of some microseconds by means of a pulse technique. The inaccuracy of measurements of refractive indices amounts to five parts in 10^8 and of absorption coefficients to two parts in 10^2 per metre. Results of measurements on ammonia are given and are compared to the results predicted by the theory of Van Vleck and Weisskopf (Rev. mod. Phys., Vol. 17, 227, 1945). A.

535.345 : 539.2

7826. THE ABSORPTIVITY OF ANISOTROPIC METALS.
R.Englman.
Proc. Phys. Soc., Vol. 72, Pt 2, 277-8 (Aug., 1958).

Expressions are given for the absorptivity of metals, deduced on the assumption that the Fermi surface is made up of an arbitrary number of ellipsoids. The results are applied to tin. C.Hilsum

535.345 : 537.228

7827. EFFECT OF A STRONG ELECTRIC FIELD ON THE OPTICAL PROPERTIES OF NON-CONDUCTING CRYSTALS.
L.V.Keldysh.
Zh. éksper. teor. Fiz., Vol. 34, No. 5, 1138-41 (1958). In Russian.

The absorption coefficient of a crystal located in a homogeneous electric field is computed for frequencies at which in the absence of the field light is not absorbed at all. It is shown that the red absorption boundary is shifted towards long wavelengths, the shift being of the order of several hundreds of angstroms at reasonable field strengths. A.

535.345

7828. ABSORPTION CHANGES OF NaCl AND KBr IN THE SHORT-WAVE INFRARED. S.Califano and M.Czerny.
Z. Phys., Vol. 150, No. 1, 1-3 (1958). In German.

Measurements made with path lengths up to 30 cm give more accurate measurements of weak short-wave absorptions, which differ a little from those of Mentzel (Abstr. 2435/1934). G.F.Lothian

535.345 : 535.328 : 539.2

THE EXCITON THEORY OF DISPERSION AND ABSORPTION OF LIGHT. See Abstr. 7499

535.345.1 : 551.46.018.9

TRANSPARENCY-METER FOR OCEAN WATER.
See Abstr. 7619

535.37 : 535.343

7829. SPECTRA AND AFTERGLOW PERIOD OF "CEMENT" PHOSPHORS. A.Pfahnl.
Acta phys. Austriaca, Vol. 11, No. 2, 252-68 (1957). In German.

Fluorescence, phosphorescence and absorption spectra of some "cement" phosphors, made by admixture of small quantities of organic molecules into magnesium oxychloride ($MgOCl_2$) hydrate, were photographed at different temperatures. The shape of the decay characteristic and the period of afterglow are determined for different temperatures and excitation times. C.Turner

535.37

7830. RADIATIVE ENERGY TRANSFER IN ZnS.
R.E.Halsted, E.F.Apple and J.S.Prener.
Phys. Rev. Letters, Vol. 1, No. 4, 134-6 (Aug. 15, 1958).

Emission and diffuse reflectivity measurements on ZnS phosphors activated with Cu, Ag and Au were made under ultraviolet and infrared excitation. ZnS:Cu samples emitted in the infrared. The long-wavelength limit of the absorption band was typical for each activator. J.Franks

535.37

7831. GLOW OF GASES IRRADIATED BY SOFT X-RAYS.
S.V.Samylov, V.A.Tsukerman and I.Sh.Model'.
Zh. éksper. teor. Fiz., Vol. 34, No. 3, 599-608 (1958). In Russian.

X-ray induced luminescence of air, nitrogen, argon and mixtures of gases was investigated in the pressure range from 0.01 to 760 mm Hg; the wavelength of the exciting radiation varied from 0.3 to 1.5 A. It is shown that the main role in excitation of glow of the gas is played by photoelectrons and recoil electrons produced as a result of interaction between the X-ray quanta and atoms of the gas. The experimental data can be satisfactorily explained by combining the gas kinetic mechanism of quenching of excited levels with absorption of X-rays in the gas. According to the experimental data the mean light yield was respectively 5×10^{-4} and 2×10^{-4} light quanta per X-ray quantum of 1.2 A wavelength absorbed in argon and air under normal conditions and 9×10^{-4} and 5×10^{-4} photons per quantum for a wavelength of 0.6 A. No X-ray luminescence of the metallic surfaces themselves was detected at intensities up to 600 roentgen/sec. It was found that the glow of the metals in air is related to luminescence of the thin gas layer contiguous to the surface induced by photoelectrons ejected from the metal by the X-ray quanta. A

535.37

7832. RELATIVE LUMINESCENCE QUANTUM EFFICIENCY MEASUREMENTS ON ACRIDINE AND FLUORESCEIN DYES.
V.Zanker, H.Rammensee and T.Haibach.
Z. angew. Phys., Vol. 10, No. 8, 357-61 (Aug., 1958). In German.

A description is given of the apparatus for increasing the relative luminescence efficiencies of dye solutions in the wavelengt range 460 to 640 mμ at room and liquid-air temperatures. Measurements were made with solutions of acridine and fluorescein in water and alcohol in the molar concentration range 2×10^{-3} to 10^{-4}. J.Franks

535.371

7833. THE POLARIZED FLUORESCENCE OF VERY THIN ANTHRACENE CRYSTALS. J.Ferguson and W.G.Schneider.
Canad. J.Chem., Vol. 36, No. 7, 1070-80 (July, 1958).

The polarized fluorescence from anthracene sublimation flakes was measured at 300°, 77°, and 4°K. A recording spectrometer was used to measure accurately the relative intensity of the two crystal polarizations and also to determine changes in the spectrum between 77° and 4°K. The polarization ratio (b/a) was found to decrease with increasing wavelength and measurements made at 77° and 4°K indicate that there is more than one emitting level and that these have different polarization properties. The fluorescence arises fro

egions of weak absorption in the crystal and it is suggested that ese regions occur in the neighbourhood of imperfections. In addion the polarized fluorescence excited from anthracene sublimation akes containing traces of tetracene was determined and changes were und in the transfer efficiency between 77° and 4°K, again suggesting e presence of more than one emitting level. No depolarization of e tetracene fluorescence was observed at low temperatures.

A.

535.371

834. LOW TEMPERATURE QUENCHING OF ENERGY RANSFER. L.E.Lyons and J.W.White.
chem. Phys., Vol. 29, No. 2, 447-8 (Aug., 1958).

Measurement of the luminescence of a solution of tetracene in nthracene (mole ratio 10^{-5}) at 4°K, 90°K and 300°K, showed that the nergy transfer from anthracene to tetracene occurring at the higher mperatures is almost entirely absent at 4°K. J.Franks

535.371

835. CROSS QUENCHING OF FLUORESCENCE IN ORGANIC OLUTIONS. M.Furst and H.Kallmann.
ys. Rev., Vol. 109, No. 3, 646-51 (Feb. 1, 1958).

Concentration quenching is usually considered to occur only tween excited and unexcited molecules of the same kind. It is here vestigated whether such quenching may also occur between molecles of different structure. Equations are given for testing its currence. By using gamma-ray-induced fluorescence of solutions ntaining a combination of two solutes, it is found that concentran quenching occurs between molecules of different structure if eir energy levels are close to each other. A.

535.371

836. NATURE OF BLUE EDGE EMISSION IN CdS.
Diemer and A.J.van der Houven van Oordt.
ysica, Vol. 24, No. 8, 707-8 (Aug., 1958).

The green and blue edge emissions from CdS crystals, and the ectron concentration vary with light intensity at 77° K as the wers of 0.7, 1.5 and 0.4 respectively. Free charge carriers must involved in the recombination processes. J.Franks

535.371

837. MEASUREMENT OF DEGREE OF POLARIZATION OF LUORESCENCE OF PURE ANTHRACENE CRYSTALLINE FILM.
K.Choudhury.
Phys., Vol. 151, No. 2, 93-105 (1958).

The polarization ratio (I_b/I_a) of a monocrystalline film of pure thracene was measured correcting for all probable errors. mparison with decay-time data reveals that the deviation from e value obtained from absorption measurements is due to a loss intensity in the a-polarized fluorescence as compared to what is pected from absorption data. This is interpreted as evidence that thracene crystal fluorescence is emitted from regions of local tice imperfections. It is confirmed that the first electronic tranion takes place along the short axis of the anthracene molecule.

A.

535.372

838. THE FLUORESCENCE SPECTRA OF URANYL ACETATE OLUTIONS. D.D.Pant and D.P.Khandelwal.
urr. Sci., Vol. 27, No. 7, 242 (July, 1958).

At room temperature the fluorescent spectrum of an aqueous olution of uranyl acetate, previously reported (Nichols and Merrit, hys. Rev., Vol. 3, No. 6, 457 (1914); Pringsheim, Fluorescence and hosphorescence, 1949) as continuous, is now found to have some tructure which improves on dilution. Addition of acetic acid reuces the intensity considerably while that of alkali at first increases but further addition causes the spectrum to become continuous ith a rapid fall of intensity; on standing overnight, the spectrum of e alkaline solution regains in intensity but changes in form. The anges which occur at liquid-air temperature are also reported.

H.H.Hodgson

535.372

839. FLUORESCENCE SPECTRUM AND LOW LEVELS OF $NdCl_3$. E.Carlson and G.H.Dieke.
chem. Phys., Vol. 29, No. 1, 229-30 (July, 1958).

The absorption and fluorescence spectra of $NdCl_3$ were measured sing $LaCl_3$ crystals containing 2% and 0.2% of Nd. A table of the low ing levels is given. J.Franks

535.372

840. LUMINESCENCE IN THE ALUMINIUM FLUORIDE ROUP. K.T.Wilke and R.Mannheim.
aturwissenschaften, Vol. 44, No. 24, 631-2 (1957). In German.

Under u.v. excitation, $CaF_2:AlF_3$ (in the ratios 3:2 and 5:2) give maxima in luminescent intensity. The emission spectrum for $3CaF_2:2AlF_3$ with 10% Ce and 4% Mn is shown from 400 to 800 mμ.

J.Franks

535.376 : 621.38

7841. ELECTRON TRAPS AND THE ELECTROLUMINESCENCE BRIGHTNESS AND BRIGHTNESS WAVEFORM. F.F.Morehead, Jr.
J. Electrochem. Soc., Vol. 105, No. 8, 461-8 (Aug., 1958).

Describes an investigation of the effect of temperature, voltage, and rise time on the size and shape of the brightness waves of electroluminescence; sawtooth and square pulse voltage waveforms were used to excite copper-activated ZnS phosphors in a slightly conducting medium. A model is proposed which accounts for the major features of the experiments. Electrons which have been ionized from a region of high field are trapped in another part of the phosphor particle. A field opposite in polarity to that which produced the ionization serves to sweep the conduction electrons, which are at every instant in thermal equilibrium with the traps, back into the high field region where the electrons recombine, with radiative emission. The model is successfully applied to measurements of the average electroluminescence brightness for sinusoidal excitation of a binderless phosphor layer as a function of temperature, frequency, and voltage. A.

535.376

7842. LUMINESCENCE OF THE OXIDE LAYER ON ALUMINIUM DURING AND AFTER ITS FORMATION BY ELECTROLYTIC OXIDATION.
W.C.van Geel, C.A.Pistorius and B.C.Bouma.
Philips Res. Rep., Vol. 12, No. 6, 465-90 (Dec., 1957).

Measurements are described of the luminescence occurring in an anodically-deposited oxide layer on aluminium. During the formation of the oxide layer a pronounced luminescence appears. When the field strength in the layer is kept constant, the luminescence L is found to increase with the thickness d according to $L = a(e^{bd} - 1)$. At constant layer thickness, L is found to be proportional to the current I, so that $L = \beta I(e^{bd} - 1)$. It is assumed that during the formation (the current then being partly an electronic current) the collisions with the ions liberate electrons, which in turn, by excitation of the ions of foreign metals, cause the luminescence. With the formed layer, the small leakage current causes a weak luminescence. An alternating voltage of sinusoidal or rectangular shape gives a flash of luminescence at every reversal of the polarity. At constant voltage the intensity of this flash is found to decrease rapidly. This is the reason why, if an alternating voltage is applied, the curve of L as a function of I or of V describes a loop. The cathode flash is explained by assuming that the layer contains traps, which are filled with electrons as soon as the Al becomes the cathode. During this process electrons recombine with the ions of foreign metals contained in the lattice. This process is of short duration. As soon as the Al becomes positive the anode flash occurs, which is considered to be the rest of the cathode flash. A.

535.376 : 539.1.07

ENERGY RESOLUTION IN SCINTILLATION COUNTERS.
See Abstr. 7222-3

535.376

7843. THE ELECTROLUMINESCENCE OF SILICON CARBIDE.
D.Rücker.
Z. angew. Phys., Vol. 10, No. 6, 254-63 (June, 1958). In German.

On application of a field biased in the forward direction across blue SiC crystals (p-type, with n-type surface layer), hole injection occurs at p—n junctions giving rise to luminescence. Under reverse bias, luminescence due to impact ionization occurs at discrete points in the p—n exhaustion layer of blue crystals, and in the surface exhaustion layer of green crystals (n-type). The maximum of the injection luminescence spectrum lies between 5100 and 6300 A, shifting to the shorter wavelengths with increasing conductivity and current density and decreasing temperature. The decay time (3-8 μsec) shortens with increasing current density. The impact luminescence emission extends from the u.v. to the red end of the spectrum, with a maximum at 4650 A; the decay time is less than 2×10^{-7} sec. J.Franks

535.391

7844. THE TEMPERATURE DEPENDENCE OF THE OPTICAL CONSTANTS OF LITHIUM FLUORIDE AND SODIUM FLUORIDE IN THE INFRARED. M.Klier.
Z. Phys., Vol. 150, No. 1, 49-63 (1958). In German.

An experimental set-up is described, which allows measurement of the extinction coefficient and reflecting power near the position of

A2

anomalous dispersion in the infrared and in the temperature range from −196° to +300° C. The extinction coefficients of LiF and NaF increased on heating; on the short wavelength side subsidiary maxima were developed at −196° C, but disappeared at higher temperatures. The reflecting powers were only slightly temperature dependent. B.T.M.Willis

535.417 : 531.715

7845. WAVELENGTH DATA AND CORRECTION TABLES FOR LENGTH INTERFEROMETRY. C.F.Bruce.
Commonwealth Sci. Industr. Res. Org. Australia, Nat. Stand. Lab. Tech. Pap. No. 8, 87 pp. (1956).

These tables include all relevant data on wavelengths, refractive indexes, and correction factors. To facilitate the reduction of results, additional tables are given of vapour pressures and of wavelength fractions with metric and inch equivalents. A.

535.417

7846. FABRY–PEROT INTERFEROMETER MIRRORS OF MULTIPLE DIELECTRIC FILMS FOR THE SPECTRAL REGION FROM 2300 to 3000 A. A.Steudel and S.Stotz.
Z. Phys., Vol. 151, No. 2, 233-40 (1958). In German.

Multiple layers of CsI or CsBr alternated with cryolite or MgF_2 give reflection of 94% and absorption of 3.5%. A protective layer of paraffin is used. G.F.Lothian

535.417 : 531.715

7847. AN APPLICATION OF TOLANSKY'S METHOD TO THE MEASUREMENT OF FILMS WITH VARIABLE THICKNESS. A.Heisen.
Z. InstrumKde, Vol. 66, No. 5, 87-91 (May, 1958). In German.

Multiple-beam fringes of equal thickness are applied to the evaluation of step heights (film thickness). It is shown how the method can be applied to a film of constant thickness, or to a wedge film in which there is regular increase of thickness, or an irregular change. It is described how measurements can be made when the steps are either perpendicular to, or alternately in the direction of the change in thickness. With thin films which are not too absorbing the refractive index can be obtained. S.Tolansky

535.42 : 538.566 : 621.396.677.833.2

7848. MEASURED PHASE DISTRIBUTION IN THE IMAGE SPACE OF A MICROWAVE LENS. G.W.Farnell.
Canad. J. Phys., Vol. 36, No. 7, 935-43 (July, 1958).

Detailed measurements at a wavelength of 3.2 cm were made of the phase distribution in the diffraction image produced by an aberration-free lens illuminated from a point source. The behaviour of the phase of the electric field is shown by contours of constant phase (wavefronts) in the plane of the image space containing the axis and the H-vector of the radiating source. The region of the image space considered extends from the solid dielectric lens to a surface somewhat beyond the focus. Results are also shown of the phase distribution measured within about one wavelength of certain phase singularities which occur at the minima of intensity on the focal arc and on the axis. In general, there is very good agreement between plots of measured phase contours and plots of phase contours previously calculated from scalar diffraction theory. A.

535.421

7849. "VIRTUAL" FRESNEL DIFFRACTION PATTERNS. R.M.Sillitto and M.D.Wilson.
Proc. Phys. Soc., Vol. 72, Pt 2, 303-5 (Aug., 1958).

The positions of the maxima and minima in the diffraction pattern produced by a straight edge and a parallel line source are calculated for any position of the plane in which the pattern is observed. A spatial inversion of the pattern occurs when the (virtual) observation plane is moved to behind the source. The results have been confirmed experimentally. E.A.Mussett

535.435 : 536.48

7850. SCATTERING OF LIGHT IN A FERMI LIQUID. A.A.Abrikosov and I.M.Khalatnikov.
Zh. éksper. teor. Fiz., Vol. 34, No. 1, 198-203 (1958). In Russian.

Scattering of light in a Fermi liquid is examined. The angular and frequency distributions are obtained. Scattering in liquid He^3 is estimated. A.

535.557 : 539.21

BIREFRINGENCE IN NEUTRON-IRRADIATED BORON GLASS. See Abstr. 7522

535.7

PHYSIOLOGICAL OPTICS. VISION. See under "Medical science. Human physiology". Decimal classification 612.84

535.81

7851. NEW VIEWPOINTS IN OPTICAL ENGINEERING. V.Ronchi.
Atti Fond. Ronchi, Vol. 13, No. 3, 236-44 (May-June, 1958). In Italian.

The performance of an optical instrument has usually been considered in terms of its "own" resolution. It is now realized that the performance can only be judged in conjunction with the source characteristics, and the optical properties of the receiver. This viewpoint is thought to be most significant in designing instruments for military purposes, for these generally have to operate under severe conditions. R.W.Fisl

535.81

7852. IMPROVED ULTRAVIOLET MICROBEAM APPARATUS. R.B.Uretz and R.P.Perry.
Rev. sci. Instrum., Vol. 28, No. 11, 861-6 (Nov., 1957).

The apparatus (utilizing the principle of incident illumination) was developed for the irradiation of small parts of living cells or other microscopic objects. A reflecting microscope objective is used simultaneously in a visible light viewing—aiming system and in a bombardment system to focus a spot of ultraviolet light (as small as 1 μ in diameter) on to part of an experimental preparation. Provision is made in the apparatus for auxiliary phase-contrast viewing and for monitoring of the energy in the microbeam. Details of construction and alignment are given and the distribution of intensities in the microbeam is discussed. A

535.81

7853. A HIGH-PRECISION SCHLIEREN APPARATUS USING MINIMUM-RAY INDICATION. L.Krausbauer.
Z. Phys., Vol. 152, No. 2, 214-34 (1958). In German.

In the minimum-ray method an interference minimum is used to define the deviation of a ray by a schlieren object. A slit and biprism were used to form straight fringes and these were deviated by one-dimensional schlieren objects. The method is claimed to be more sensitive than previous systems. W.T.Welford

535.826 : 539.27

A METHOD FOR THE SELECTION AND PREPARATION OF A PARTICULAR AREA IN THE OPTICAL MICROSCOPE FOR [SUBSEQUENT] ELECTRON MICROSCOPE INVESTIGATIONS. See Abstr. 7552

535.8

7854. ALUMINUM–NICKEL MIRROR. J.H.Saxton.
J. Opt. Soc. Amer., Vol. 48, No. 8, 583 (Aug., 1958).

A method is described which produces an optical reflecting surface upon a solid aluminium substrate. Other metals or even some plastics may be used. After machining, the metal is nickel plated, lapped with diamond dust and evaporated with aluminium and silicon monoxide. The method is said to be suitable for multifaced mirror drums, reflecting choppers etc. R.W.Fis

535.89 : 535.24

7855. MEASUREMENT OF THE INTENSITY OF THE 1849 A LINE OF A LOW-PRESSURE MERCURY LAMP. E.Sauter.
Z. angew. Phys., Vol. 9, No. 3, 105-7 (March, 1958). In German.

The 1849 A (but not the 2537 A) line ionizes water vapour and the charge collected by an electrometer may be used to determine the intensity. G.F.Lothia

HEAT

536.21 : 534.23 : 538.2

7856. ON THE THEORY OF THERMAL CONDUCTIVITY AND ABSORPTION OF SOUND IN FERROMAGNETIC DIELECTRICS. A.I.Akhiezer and L.A.Shishkin.
Zh. éksper. teor. Fiz., Vol. 34, No. 5, 1267-71 (1958). In Russian.

The temperature dependence of the thermal conductivity and the absorption coefficient of sound in ferromagnetic substances is determined. It is shown that at low temperatures the main role in these processes is played by spin waves. A

536.21 : 537.58

THE THERMAL CONDUCTIVITY OF AN OXIDE CATHODE. See Abstr. 7141

536.212.2 : 537.311.3

DETERMINATION OF THE LORENZ NUMBER AT HIGH TEMPERATURES. See Abstr. 6957

536.212.3

857. ON THE CYLINDRICAL PROBE METHOD OF MEASURING THERMAL CONDUCTIVITY WITH SPECIAL REFERENCE TO OILS. I. EXTENSION OF THEORY AND DISCUSSION OF PROBE CHARACTERISTICS. D.A.de Vries and A.J.Peck.
Australian. J. Phys., Vol. 11, No. 2, 255-71 (June, 1958).

The theory of cylindrical probes for measuring thermal conductivity is extended to the case of a probe of finite conductivity containing a line source at its centre. This provides a more realistic approximation to most actual probes than the theory for a probe of infinite conductivity developed by other authors. New experimental results are presented which are in complete agreement with theory. It is shown how an estimate can be obtained of the magnitude of a possible thermal contact resistance between the probe and the medium and how its influence on the measured conductivity can be assessed. Conditions under which the theory of the infinite line source can be applied with a sufficient degree of accuracy are treated. The properties of various probes described in the literature are reviewed in this respect. The importance of measuring both the heating and the cooling branch of the temperature against time curve is emphasized. Difficulties in measuring thermal diffusivity with the probe are briefly discussed. A.

536.212.3

858. CALCULATION OF THE THERMAL CONDUCTIVITY OF POROUS MEDIA. W.Woodside.
Canad. J. Phys., Vol. 36, No. 7, 815-23 (July, 1958).

The problem of determining the effective thermal conductivity of porous and other composite materials from the conductivities and volume fractions of their constituents is examined. An approximate equation is derived for the case of a cubic lattice of identical spherical particles in a medium having properties different from those of the particles. This equation is applied to the calculation of the thermal conductivity of snow at different densities in the range from .10 to 0.48 gm/cm^3. The effect of water vapour diffusion in snow under a temperature gradient is taken into account by adding a latent heat term to the conductivity value for dry air. Conductivity values for snow, calculated in this manner, are found to agree satisfactorily with experimental data. An equation due to Russell is also shown to give conductivity values for several cellular thermal insulating materials, which are in good agreement with experimental values. A.

536.252 : 538.65

859. STEADY-STATE CONVECTIVE MOTION OF AN ELECTRICALLY CONDUCTING LIQUID BETWEEN PARALLEL PLANES IN A MAGNETIC FIELD. G.Z.Gershuni and E.M.Zhukhovitskiĭ.
Zh. éksper. teor. Fiz., Vol. 34, No. 3, 670-4 (1958). In Russian.

Steady-state convection of an electrically conducting liquid in the space between parallel planes heated to various temperatures in the presence of a magnetic field is considered. The distribution of velocity, temperature and induced field is determined. The convective heat flow is computed. A.

536.252 : 538.65

860. ON STABILITY OF STEADY-STATE CONVECTIVE MOTION OF AN ELECTRICALLY CONDUCTING LIQUID BETWEEN PARALLEL VERTICAL PLANES IN A MAGNETIC FIELD. G.Z.Gershuni and E.M.Zhukhovitskiĭ.
Zh. éksper. teor. Fiz., Vol. 34, No. 3, 675-83 (1958). In Russian.

An investigation is carried out of the effect of a constant magnetic field on stability of steady-state convective motion of an electrically conducting liquid in the space between parallel vertical planes. The equations for the perturbation amplitudes are solved approximately by Galerkin's method. It is demonstrated that the magnetic field considerably increases the stability of the motion. Two types of instability are possible in the case of a field transverse with respect to the planes, one referring to travelling and the other to standing perturbations. Only instability with respect to standing perturbations is possible in the case of a longitudinal field. For the perturbations under consideration the values of the critical Grasshoff number and critical wave-number are computed as functions of the field. A.

536.33 : 536.4

861. ON RADIATION COOLING OF AIR. I. GENERAL DESCRIPTION OF THE PHENOMENON AND A WEAK COOLING WAVE. Ya.B.Zel'dovich, A.S.Kompaneets and Yu.P.Raĭzer.
Zh. éksper. teor. Fiz., Vol. 34, No. 5, 1278-87 (1958). In Russian.

Non-stationary radiation cooling of a large volume of air heated to a high temperature (of the order of tens and hundreds thousands degrees) as a result of a strong explosion is considered. It is shown that due to a strong dependence of light absorption in the air the cooling involves the propagation of a sharp temperature jump, that is, of cooling wave. Cooling from the initial high temperature to that at which the air becomes almost transparent and ceases to radiate occurs in a narrow wave front. A system of equations is set up which permits one to investigate the internal structure of the cooling wave and to find the connection between its parameters and the propagation velocity. A weak wave with a small temperature difference is considered. A.

536.33 : 536.4

7862. ON RADIATION COOLING OF AIR. II. A STRONG COOLING WAVE. Ya.B.Zel'dovich, A.S.Kompaneets and Yu.P.Raĭzer.
Zh. éksper. teor. Fiz., Vol. 34, No. 6, 1447-54 (1958). In Russian.

A radiation cooling wave in air with a large temperature jump is considered. It is shown that irrespective of the magnitude of the upper temperature it is always the lower boundary of the wave which radiates and that radiation transfer within a strong wave is always of the nature of radiative thermal conductivity. The state of a strong wave with adiabatic cooling is considered. A.

536.423.1 : 532.62

SPHERICAL BUBBLE GROWTH. See Abstr. 7740

536.441

7863. ISOTOPE EFFECT AT CRITICAL TEMPERATURE. I.B.Rabinovich and V.A.Gorbushenkov.
Dokl. Akad. Nauk SSSR, Vol. 120, No. 3, 566-9 (1958). In Russian.

Tabulates the experimentally determined critical temperatures and specific volumes of C_6H_6, $C_6H_5CH_3$, CH_3NO_2, $CHCl_3$, C_2H_5OH and five higher secondary and tertiary alcohols and of the same compounds with D substituted for all or some of the H atoms. The D compounds show a lower T_c than the H ones, which is in agreement with the literature data for some other compounds, the only exceptions being He and H, where the heavier isotope has a higher T_c. An attempt is made to show that all these findings are corroborated by theoretical considerations according to which compounds with a relatively high T_c have $T_{c,D} < T_{c,H}$, whereas those with a very low T_c should have $T_{c,D} > T_{c,H}$. F.Lachman

536.48 : 536.5 : 538.222

7864. THE MAGNETIC MEASUREMENT OF VERY LOW TEMPERATURES BY THE METHOD OF BEATS. F.X.Eder.
Exper. Tech. der Phys., Vol. 6, No. 2, 74-8 (1958). In German.

The change in frequency of an oscillator including a coil with a paramagnetic core, is proposed as a method of continuously monitoring the temperature in adiatatic demagnetization experiments. Apparatus in which the thermometer oscillator is compared with a fixed frequency oscillator, and beats can be measured to 0.05 c/s, is described. The apparatus has been tested at temperatures between 14°K and 290°K. A.J.Manuel

536.48 : 536.71

7865. EQUATIONS OF STATE FOR LIQUID HELIUM. G.Borelius.
Ark. Fys., Vol. 13, Paper 29, 369-78 (1958).

Liquid He I and liquid He^3 are formally treated as Fermi gases in a free volume $\beta < V_0$, the molar volume. This procedure is possible because the specific heat of He I and the difference between the total specific heat and the nuclear spin heat of He^3 are both approximately proportional to the absolute temperature T. The isopycnals of He I are of the form $P = a + bT^3$. This also agrees with the Fermi gas formalism. From the experimental He I isopycnal, which extrapolates to $P \to 0$ for $T \to 0$, a value $\beta/V_0 = 0.8$ is obtained, and from the proportionality factor of the specific heat, $\beta/V_0 = 0.64$. The latter value is considered less reliable because of uncertainties in the corrections which take account of the thermal-expansion. For He^3 the value of β/V_0 obtained from the specific heat is 0.49. H.London

536.48 : 535.325

7866. REFRACTIVE INDEX OF He^4: SATURATED VAPOR. M.H.Edwards.
Phys. Rev., Vol. 108, No. 5, 1243-5 (Dec. 1, 1957).

The refractive index n of saturated helium vapour was measured from 1.5 to 4.2°K, by means of a Jamin interferometer and a metal cryostat with optically flat windows. About 200 experimental points were taken. For the Hg green line, $\lambda = 5462.27$ A, $(n-1)$ increases smoothly from $(31 \pm 2) \times 10^{-6}$ at 1.5°K to $(3300 \pm 15) \times 10^{-6}$ at 4.2°K. Eight separate absolute determinations of $(n-1)$ were made over this temperature range and the results were combined with the calculated vapour density to give the polarizability per mole, $N_0\alpha$. The mean polarizability is 0.1245 ± 0.0005 cm^3/mole. Individual determinations from 1.8° to 4.2°K do not deviate from this by more than 0.0008. This

value should be compared with 0.1246 ± 0.0002 cm^3/mole which may be calculated from the measurements of (n−1) for helium gas at N.T.P. A.

536.48

7867. THE RATE OF FILM TRANSFER IN HELIUM ISOTOPES. B.N.Esel'son, A.D.Shvets and R.A.Bablidze.
Zh. éksper. teor. Fiz., Vol. 34, No. 1, 233-4 (1958). In Russian.

Measurements were made with solutions containing 1.5, 4.7, 7.0 and 9.6% of He^3. Temperatures were varied between 1.95 and 2.2° K. Results are given in two sets of graphs in which the product of the velocity of film transfer and the thickness of the film is plotted against the temperature (at constant concentration) and the concentration (at constant temperature) respectively. The product decreases with increasing temperature and with increasing concentration. R.Eisenschitz

536.48

7868. VISCOSITY OF LIQUID He^3 BETWEEN 0.35 AND 3.2° K, AND OF He^4 ABOVE THE λ-POINT. K.N.Zinov'eva.
Zh. éksper. teor. Fiz., Vol. 34, No. 3, 609-15 (1958). In Russian.

The viscosities were measured using a capillary tube viscosimeter. The viscosity was found to increase slowly with lowering of the temperature from 3.2° to 1.0° K; below 1° K the increase was much greater. The temperature dependence of η in the interval from 0.5° to 1.1° K can be satisfactorily described by the formula $T^{-1/2}$; only below 0.5° K is the dependence stronger (but weaker than T^{-3}). Measurements of the viscosity of He^4 above the λ-point indicate that its temperature dependence is not different from that of usual liquids, excluding the region near the λ-point. A.

536.48 : 534.22

THE VELOCITY OF SOUND IN A 2.7% He^3 – He^4 MIXTURE. See Abstr. 7766

536.48 : 535.435

SCATTERING OF LIGHT IN LIQUID He^3. See Abstr. 7850

536.48

7869. ON THE THEORY OF SUPERFLUIDITY. V.L.Ginzburg and L.P.Pitaevskiĭ.
Zh. éksper. teor. Fiz., Vol. 34, No. 5, 1240-5 (1958). In Russian.

Equations describing behaviour of superfluid helium near the λ-point were obtained in the stationary case taking into account quantum effects. The properties of thin films and a vortex line in helium near the λ-point are discussed. A.

536.5 : 621.36

7870. PRODUCTION OF A SQUARE TEMPERATURE WAVE IN FILAMENTS OPERATING AT LOW TEMPERATURES. R.Klein and J.A.Simpson.
Rev. sci. Instrum., Vol. 29, No. 9, 770-3 (Sept., 1958).

The problem of obtaining fast rising temperatures by resistance heating in a filament initially at low temperatures is examined. From a solution of the heat conduction equation the relationships, both steady state and transient, among temperature, heating current and heating power are derived. The solutions are dependent on the initial temperature, the thermal properties of the filament, and its physical dimensions. For a typical filament the current–temperature curves are of the form $i = F + (B/T)$, where B is negative for 77° K boundary temperature, zero for approximately 50° K, and positive below this temperature. Experimental evidence taken with a 0.1 mm diam. tungsten filament 2.5 cm long confirms these predictions. A circuit capable of raising a filament from any temperature above 4.2° K to any desired temperature below 600° K in less than 0.3 sec is described. A.

536.531 : 621.317.39

7871. RESISTANCE THERMOMETER BRIDGE FOR MEASUREMENT OF TEMPERATURES IN THE LIQUID HELIUM RANGE. C.Blake, C.E.Chase and E.Maxwell.
Rev. sci. Instrum., Vol. 29, No. 8, 715-16 (Aug., 1958).

A 33 c/s resistance thermometer bridge, suitable for precise temperature measurements in the liquid helium range, was designed as a completely self-contained unit. The amplifier has a gain of 120 dB, bandwidth of 0.3 c/s, and input impedance of 10 kilohms. With a power dissipation of 2×10^{-8} W in the thermometer, resistance changes of 0.1 ohm can be detected. For a typical resistance thermometer this corresponds to a temperature change of 4×10^{-6} deg K at 2° K. Other features include high rejection of line-frequency pickup, short recovery time after saturation, and a combination gain bandwidth control which shortens the response time during preliminary balancing operations. A.

536.531 : 621.317.39

7872. RAPID HIGH-SENSITIVITY RECORDING THERMOMETER. R.W.Stow.
Rev. sci. Instrum., Vol. 29, No. 9, 774-5 (Sept., 1958).

A rapid high-sensitivity thermistor thermometer is described, including the circuit details for the activation of the thermistor bridge circuit and associated amplifier. Using a small bead thermistor housed in a hypodermic needle, the 95% response time is about 0.17 sec, and noise levels as low as 2×10^{-4} °C have been obtained. A.

536.532

7873. ERROR IN TEMPERATURE MEASUREMENT DUE TO THE INTERDIFFUSION AT THE HOT JUNCTION OF A THERMOCOUPLE. A.J.Mortlock.
J. sci. Instrum., Vol. 35, No. 8, 283-4 (Aug., 1958).

Temperature measurement errors due to interdiffusion at the hot junction of a thermocouple are discussed and corresponding theoretical expressions derived. Applying these it is found, for example, that a platinum/platinum-13% rhodium thermocouple in a gradient of 10 deg C/cm maybe in error to the extent of about 1.3 deg C at all temperatures within the normal operating range following a heat treatment equivalent to 100 days at 1500° C. This is so only if the thermocouple is used in the conventional way with its arms parallel. If the same thermocouple were operated with its arms arranged in an antiparallel fashion, the error would be less. A

536.63

7874. NORMAL AND SUPERCONDUCTING HEAT CAPACITIES OF LANTHANUM. A.Berman, M.W.Zemansky and H.A.Boorse.
Phys. Rev., Vol. 109, No. 1, 70-6 (Jan. 1, 1958).

The heat capacities of three samples of lanthanum were measured in the temperature range from 1.6 to 6.5° K. A four-constant formula was found which represented to high precision the resistance-temperature relation of the carbon composition resistance thermometer from 1.6° to 7.2° K. Two superconducting transitions were found in each sample: one at 4.8° K and the other at 5.9° K. These are associated respectively with the hexagonal close-packed and face-centred cubic modifications of the metal. Below 2.5° K, a magnetic field of 10 000 G was found insufficient to quench completely the superconducting phase. The values of the normal heat capacity constants for the purest sample, averaged over the two crystal structures present, were determined by a thermodynamic analysis of the data to be $\gamma = (24.1 \pm 0.6) \times 10^{-4}$ cal/mole (deg K)^2, $\Theta = 142 \pm 3$° K. The data are further analysed for evidence of a law of corresponding states among superconductors. A

536.63

7875. SPECIFIC HEAT OF BISMUTH BETWEEN 0.3 AND 4.4° K. I.N.Kalinkina and P.G.Strelkov.
Zh. éksper. teor. Fiz., Vol. 34, No. 3, 616-21 (1958). In Russian.

The specific heat of spectrally pure bismuth was measured in the temperature interval from 0.3 to 4.4° K. Below 1.8° K the coefficient in the T^3-term in the formula for the temperature dependence of the specific heat corresponds to $\Theta_D = 118.5 \pm 1$° K, the coefficient in the linear term of the specific heat is $\gamma = 1.6 \times 10^{-3}$ cal deg^{-2} gram-atom which is by an order of magnitude smaller than that for most metals. The linear term is compared with the specific heat of electrons computed on basis of the de Haas–van Alphen effect. A

536.631 : 536.424

7876. ON THE INFLUENCE OF SHORT-RANGE ORDER ON THE SPECIFIC HEAT NEAR A PHASE-TRANSITION POINT OF THE SECOND KIND. V.M.Zaitsev.
Zh. éksper. teor. Fiz., Vol. 34, No. 5, 1302-5 (1958). In Russian.

An approximate expression was obtained for the binary distribution function near a phase-transition point of the second kind. The expression is employed to determine the specific heat above the Curie point. A

536.63

7877. THE MEASUREMENT OF SPECIFIC HEATS OF POOR HEAT CONDUCTING SUBSTANCES. W.Kangro and F.Rosskopf.
Z. angew. Phys., Vol. 9, No. 2, 98-103 (Feb., 1957). In German.

A modified form of the adiabatic calorimeter of Kangro and Grau (Abstr. 3526/1931), which is suitable for poor conducting materials, is described. To test the apparatus measurements were made of the specific heats of Fe_2O_3 and corundum at room temperature. S.Weintro

536.631 : 539.2

CALCULATION OF THE SPECIFIC HEAT OF THE NaCl CRYSTAL. See Abstr. 7482

THERMODYNAMICS

536.7 : 533.6 : 532.5

MULTIPLICITY THEOREMS AND AN EXACT SOLUTION IN DIABATIC FLOW. See Abstr. 7729-30

536.7 : 530.145 : 533.6 : 532.5

SOME ASPECTS OF DIABATIC FLOW AND GENERAL INTERPRETATION OF THE WAVE MECHANICS FUNDAMENTAL EQUATION. See Abstr. 7731

ELECTRICITY

ELECTROSTATICS. DIELECTRICS

537.222 : 537.562

7878. A THEORETICAL STUDY OF THE FLUX OF IONS CAPTURED BY CONDUCTING ELLIPSOIDS AND ELLIPTICAL CYLINDERS IN AN ELECTRIC FIELD WITH FREE IONIZATION.
E.Cochet and J.Dupuy.
C.R. Acad. Sci. (Paris), Vol. 246, No. 26, 3595-8 (June 30, 1958).
In French.

This work has reference to electrostatic precipitators, etc. Ion currents are calculated in terms of potential distributions, for certain electrode dispositions, ionic mobility, etc. J.D.Craggs

537.226.1

7879. A PROPERTY OF DIELECTRIC CONSTANTS OF DIELECTRICS IN THERMAL EQUILIBRIUM. M.Peter.
J. Math. and Phys., Vol. 36, 347-50 (1957).

The fundamental properties of dielectrics and examined and a criterion is established to determine whether a particular material is passive or contains energy sources so that power may be derived from it. C.A.Hogarth

537.226.1 : 621.315.612.4

7880. FERROELECTRIC CRYSTALS AND CERAMICS.
J.M.Herbert.
J. Electronics and Control, Vol. 5, No. 2, 168-92 (Aug., 1958).

Comprehensive review. 36 references.

537.226.2

7881. THE NATURE OF THE DIELECTRIC LOSSES IN SODIUM ALUMINIUM SILICATE GLASSES. V.A.Ioffe.
Zh. tekh. Fiz., Vol. 27, No. 7, 1454-61 (1957). In Russian.

The relation between dielectric losses and oxygen number (degree of polymerization of structural lattice) was investigated in the temperature range 20-190°K at frequencies 10^6, 2.3×10^5 and 7×10^6 c/s. In all cases the losses rise with falling oxygen number at all the temperatures. This does not fit into the accepted interpretations of the nature of dielectric losses in glasses. The author supposes that the dielectric properties of glasses with non-tetravalent ions are due to ionic and electronic processes.
Electrical Research Association

537.226.2

7882. DIELECTRIC RELAXATION LOSSES IN IONIC CRYSTALS (PRELIMINARY COMMUNICATION).
A.A.Voĭtsekhovskaya, L.A.Golubeva and E.V.Tyutyunnikova.
Zh. tekh. Fiz., Vol. 27, No. 7, 1591-3 (1957). In Russian.

Tan δ measurements on a pure KCl monocrystal in the range 7×10^2-10^6 c/s, revealed a distinct relaxation maximum at 7×10^3 c/s, 0°C, shifting with rising temperature to higher frequencies. Frequency relation agrees well with Skanavi's formula. Investigation of temperaure dependence at 10^3 and 5×10^4 c/s revealed maxima at °C and 160°C. Activation energies were calculated. A KCl crystal with CuCl admixture was also examined. Tan δ_{max} in such a crystal was found to be at the same frequency as in a pure monocrystal. Electrical Research Association

537.226.2 : 535.325

BEHAVIOUR OF THE DIELECTRIC CONSTANT OF NH_3 IN THE REGION OF THE INVERSION SPECTRUM AT PRESSURES FROM 10^{-3} TO 1 TORR, WITH SPECIAL REFERENCE TO THE LINE J = 3, K = 3. See Abstr. 7792

537.226.2

7883. NEW ROOM-TEMPERATURE FERROELECTRIC.
R.Pepinsky, K.Vedam and Y.Okaya.
Phys. Rev., Vol. 110, No. 6, 1309-11 (June 15, 1958).

The neutral-salt complex with glycine, di-glycine manganous chloride dihydrate, $(NH_2CH_2COOH)_2 \cdot MnCl_2 \cdot 2H_2O$, is found to be ferroelectric from low temperatures to +55°C. Above the latter temperature the conductivity suddenly becomes excessive. At room temperature the spontaneous polarization is 1.3×10^{-6} coulomb/cm² and the coercive field is 5.6 kV/cm. A nonreversible surface change is observable optically above 72°C, probably due to loss of H_2O. Thermal measurements indicate onset of water loss above 35°C; electrical conductivity increases sharply and irreversibly above 55°C, and care must be taken to prevent dehydration even at room temperature. No Curie temperature can be observed. X-ray measurements of this hitherto unreported salt show space group $P2_1$, a = 9.96, b = 8.53 A, c = 6.86 A, $\beta = 107 \pm 0.5°$, density = 1.855_0 g/cm³, and two formula units per cell. The ferroelectric axis is along b. The dielectric constants at room temperature are $\epsilon_a = 8.1$, $\epsilon_b = 8.1$, $\epsilon_c = 7.4$; and these decrease linearly and only very slightly as the temperature is lowered to 77°K. The corresponding neutral-salt complex of two glycines with $MnBr_2$ is not isomorphous, occurring as a tri-hydrate, and is not ferroelectric. It has not been possible to find any metal which will replace manganese and form an isomorphous crystal.
A.

537.226.2

7884. THE POLARIZATION REVERSAL PROCESS IN FERROELECTRIC SINGLE CRYSTALS. M.Prutton.
Proc. Phys. Soc., Vol. 72, Pt 2, 307-8 (Aug., 1958).

Calculated values, both of the energy required to form a nucleus of reversed polarization and of the minimum domain size, are much too large for the thermal generation of nuclei to be feasible. The surface layers in ferroelectric crystals could, however, provide very small nuclei permanently situated at the surfaces of the crystal. These layers might also produce the permanent bias sometimes observed in the hysteresis loops of certain crystals.
R.C.Kell

537.226.2

7885. UPPER CURIE TEMPERATURE AND DOMAIN STRUCTURE IN DIFFERENT REGIONS OF ROCHELLE SALT CRYSTALS.
H.E.Müser and H.Flunkert.
Z. Phys., Vol. 150, No. 1, 21-32 (1958). In German.

The domain structure has the form of strips parallel to the b or c axis of the crystal, the former being observed in those regions which have grown on (001) crystal planes, whose Curie temperature is in addition ½ deg C above that of the rest of the crystal. The dielectric constant in the ferroelectric direction reaches 1.5×10^4 at both Curie points. E.P.Wohlfarth

537.226.2

7886. DIELECTRIC PROPERTIES OF BARIUM TITANATE AT HIGH FREQUENCIES AND LOW TEMPERATURES.
H.Rabenhorst and J.Melicherčík.
Ann. Phys. (Leipzig), Folge 7, Vol. 1, No. 4-5, 261-3 (1958).
In German.

Ceramic $BaTiO_3$ containing 4% $PbTiO_3$ was measured down to −180°C at 9.1×10^9 c/s. Apart from the expected maxima in permittivity at −10° and −70°C, a rise occurred in going from −160° to −180°C. K.W.Plessner

537.226.2 : 539.371

7887. ANISOTROPY IN POLARIZED BARIUM TITANATE CERAMICS. M.Marutake and T.Ikeda.
J. Phys. Soc. Japan, Vol. 12, No. 3, 233-40 (March, 1957).

Dielectric constants ϵ_1^T and ϵ_3^T (perpendicular and parallel to the direction of the polarization) and elastic compliance coefficients s_{11}^E, s_{33}^E and s_{44}^E of fully prepolarized $BaTiO_3$ ceramics are measured, and are compared with the dielectric constant ϵ^0 and the elastic compliance coefficients s_{11}^0 and s_{44}^0 of the unpolarized ceramics. Anisotropy is small (a few per cent). By semi-quantitative calculations, it is shown that the 180°-reversals of domains mainly remain after the polarization process, and that anisotropy is due to the piezoelectric interactions among single crystals which constitute the ceramic. A.

537.226.2

7888. SOME STUDIES ON THE TERNARY SYSTEM (Ba-Pb-Ca)TiO_3. T.Ikeda.
J. Phys. Soc. Japan, Vol. 13, No. 4, 335-40 (April, 1958).

The phase relation and the dielectric and mechanical properties of ceramic samples of the ternary system (Ba-Pb-Ca)TiO_3 are

studied. The ferroelectricity of the solid solution (Ba-Pb)TiO_3 decreases with increasing Ca concentration and disappears at about 50 mole% of $CaTiO_3$; then the structure changes to cubic, pseudocubic and orthorhombic. A certain insoluble region exists in the vicinity along the (Ba-Ca)TiO_3 side. The dielectric and piezoelectric constants of $BaTiO_3$ decrease with increasing concentration of $PbTiO_3$ and $CaTiO_3$. The dielectric and mechanical Q's vary in parallel with composition. A.

537.226.2

7889. DIELECTRIC PROPERTIES OF SINGLE DOMAIN CRYSTALS OF $BaTiO_3$ AT MICROWAVE FREQUENCIES.
T.S.Benedict and J.L.Durand.
Phys. Rev., Vol. 109, No. 4, 1091-3 (Feb. 15, 1958).

Small-signal dielectric constant measurements were made on single domain crystals of $BaTiO_3$ from 25° to 170° C at 24 kMc/s. A typical Curie behaviour was observed with a dielectric constant ϵ_{11} of about half the d.c. value below the upper Curie point. Measurements of ϵ_{11} were also made with a d.c. field (E_3) applied along the c-axis in order to obtain information concerning the distortion of the potential well perpendicular to the c-axis when the ion is displaced along the c-axis. The change $\Delta\epsilon_{11}$ observed was about 50 for an applied field of 10^4 V/cm. A.

537.226.2 : 621.315.612.4

7890. THEORY OF THE FERROELECTRIC PROPERTIES OF POLARIZED BARIUM TITANATE CERAMICS.
L.P.Kholodenko and M.Ya.Shirobokov.
Zh. tekh. Fiz., Vol. 27, No. 5, 929-35 (1957). In Russian.

The problem of $BaTiO_3$ polycrystals is complicated by inhomogeneous residual stresses, internal fields, mosaic and domain nature of crystal structure. The authors treat the problem of an "ideal" polycrystal, i.e. they neglect all these inhomogeneities and also assume the vectors of spontaneous polarization of the crystallites to make minimum angles with the resultant polarization of the polycrystal. Tensors of the dielectric constant and piezomoduli are found for tetragonal and orthorhombic phases of the crystals.
Electrical Research Association

537.226.2 : 621.315.612.4

7891. INVESTIGATION OF THE EFFECT OF ONE-SIDED COMPRESSION ON THE DIELECTRIC CONSTANT OF $BaTiO_3$ CERAMICS IN STRONG FIELDS. I.A.Izhak.
Zh. tekh. Fiz., Vol. 27, No. 5, 953-61 (1957). In Russian.

The dielectric constant of polycrystalline barium titanate under one-sided compression is reduced along the stress direction and increased in the perpendicular direction. The relative variation depends on field strength applied and temperature, and reaches 6×10^{-4} cm^2/kg. The time to reach steady-state after pressure variations is not constant and depends on field strength and temperature, also on impurities. Electrical Research Association

537.226.2 : 548.55

FERROELECTRIC $PbTiO_3$ CRYSTALS. See Abstr. 7598

537.228.1

7892. ELASTIC AND PIEZOELECTRIC COEFFICIENTS OF SINGLE-CRYSTAL BARIUM TITANATE.
D.Berlincourt and H.Jaffe.
Phys. Rev., Vol. 111, No. 1, 143-8 (July 1, 1958).

Mechanical resonance and antiresonance frequencies were measured on barium titanate single-crystal elements maintained under electric d.c. bias from −50° to +150°C. A complete set of elastic, piezoelectric, and dielectric constants of the tetragonal modification at 25°C is obtained. The elastic compliances show substantial deviation from cubic symmetry. Measurements in the orthorhombic state show longitudinal compliance four times higher than in the tetragonal state. A.

537.228.1 : 534.131

THE ELECTRICAL EQUIVALENT SCHEMES OF VIBRATING PIEZOELECTRIC CRYSTAL BARS. See Abstr. 7758

537.228.2

7893. ELECTROSTRICTION IN BARIUM TITANATE ABOVE THE CURIE POINT. G.Schmidt.
Naturwissenschaften, Vol. 45, No. 1, 8-9 (1958). In German.

The electrostrictive constants can be determined above the Curie point from direct measurements of strain and polarization, there being no domain effects. Measurements on three crystals, two yellow and one black, showed that Q_{11} and Q_{33} were practically constant at high temperatures, the mean values being a little lower than those calculated by Kay (Abstr. 7944/1955); who assumed that the tetragonal deformation is due to electrostrictive strain produced by the spontaneous polarization, and therefore also that the constants are essentially independent of temperature. Anomalies, probably due to small domains developing well above the Curie point (48° C), were observed even at 100° C in the black crystal, but not above 70° C in the yellow crystals. R.C.Kel

537.228.2

7894. THE ELECTROSTRICTION OF DIPOLAR FLUIDS.
H.Goetz and W.Zahn.
Z. Phys., Vol. 151, No. 2, 202-9 (1958). In German.

By the application of a unidirectional and an alternating electri field to a dipolar liquid, an alternating pressure is produced. This is the sum of an electrostrictional pressure and a pressure due to Coulomb forces between the electrodes. An experimental arrangement for studying the electrostrictional pressure is described, and results on four liquids are given. A.E.De Barr

ELECTRIC CONDUCTION. CURRENTS

537.311.1

7895. THEORY OF THE RESIDUAL ELECTRICAL RESISTANCE OF INTRUSION ALLOYS. A.A.Smÿrnov and I.O.Stoyanov.
Ukrayin. fiz. Zh., Vol. 1, No. 4, 323-38 (1956). In Ukrainian, with summary (2½ p.) in Russian.

A theory is developed of a simplified model of an alloy in whic the potential energies of the conductivity electrons in a field of ions of a different kind substituted for the junctions of the lattice, differ little from them, whilst in the field of the ions introduced into the interjunctions it is feasible to consider them as a small perturbation. The variation is determined of the residual electrica resistance with alloy composition, with the long-range order parameters and the correlation (close range order) parameters between substitution by atoms of the various sets of junction and interjunction sites. C.R.S.Mander

537.311.1 : 538.6

7896. ON THE THEORY OF GALVANOMAGNETIC PHENOMENA IN METALS. F.G.Bass, M.I.Kaganov and V.V.Slezov.
Fiz. Metallov i Metallovedenie, Vol. 5, No. 3, 406-11 (1957). In Russian.

Formulae are derived for the electrical resistivity and Hall parameter of a metal in an arbitrary magnetic field. The evaluatio uses the two-zone model of a metal and assumes a dispersion law with quadratic anisotropy. A.F.Brow

537.311.3 : 538.27 : 537.32

7897. ON THE GALVANOMAGNETIC, THERMOMAGNETIC, AN THERMOELECTRIC EFFECTS IN ISOTROPIC METALS AND SEMICONDUCTORS. E.J.Moore.
Austral. J. Phys., Vol. 11, No. 2, 235-54 (June, 1958).

The calculation of the galvanomagnetic, thermomagnetic, and thermoelectric effects in those isotropic metals and semiconductor which can be represented by the two-band model is simplified and extended to cases not previously treated. General expressions are obtained for effects involving time-independent electric fields, mag netic fields, and thermal gradients. Analytic formulae are given for the isothermal galvanomagnetic effects when a h.f. electric fiel is applied together with a time-independent magnetic field. Throughout, emphasis is placed on coefficients which are experimentally or theoretically important. The parameters occurring in the two-band model of metals and semiconductors are estimated. A

537.311.

7898. A NEW METHOD FOR THE EVALUATION OF ELECTRIC CONDUCTIVITY IN METALS. S.F.Edwards.
Phil. Mag. (Eighth Ser.), Vol. 3, 1020-31 (Sept., 1958).

A method is developed which allows the evaluation of the close formal expressions for electrical conductivity which have recently been developed by several authors. The case of a random set of scatterers is treated in detail and the formal solution made to yiel directly the solution to the Boltzmann equation. A brief mention o the application of this method to liquids and alloys is made.

537.311.3

7899. RESIDUAL RESISTIVITY OF COPPER AND SILVER ALLOYS: DEPENDENCE ON PERIODIC TABLE. F.J.Blatt.
Phys. Rev., Vol. 108, No. 2, 285-90 (Oct. 15, 1957).

Attention is called to the fact that polyvalent impurities of the silver period of the periodic table give rise to a smaller residual resistivity in both copper and silver than do polyvalent impurities

belonging to the copper period. An explanation of this experimental results is presented. The explanation is based on a modification of the Friedel sum rule suggested by Harrison by which one may take lattice distortion into account. The calculated results reflect in every detail the qualitative features of the experimental data and, moreover, lead to better quantitative agreement between theory and experiment than previous calculations based on the free-electron model. The occurrence of a similar period dependence of the thermoelectric power of these alloy systems is suggested. A.

537.311.31

7900. RESIDUAL RESISTIVITY OF GOLD ALLOYS: DEPENDENDENCE ON PERIODIC TABLE. F.J.Blatt.
Phys. Rev., Vol. 108, No. 5, 1204-6 (Dec. 1, 1957).

See preceding abstract. The residual resistivities of dilute alloys of gold are calculated by the same method. The calculated results agree well with experiment with the exception of the alloys gold–copper and gold–silver. The application of the modification of the Friedel sum condition to other problems is suggested. A.

537.311.31 : 536.48

7901. "SIZE EFFECT" IN ELECTRICAL RESISTIVITY MEASUREMENTS ON SINGLE CRYSTALS OF HIGH-PURITY TIN AT LIQUID HELIUM TEMPERATURES. J.E.Kunzler and C.A.Renton.
Phys. Rev., Vol. 108, No. 6, 1397 (Dec. 15, 1957).

The "size effect" in the electrical resistivity of a single crystal of high purity tin was observed by reducing the cross-sectional area of the crystal by chemical etching. Assuming 100% diffuse scattering of the electrons at the boundaries, the mean free path is 0.45 mm, $R_{4.2\,°K}/R_{273\,°K} = 3.5 \times 10^{-5}$, and $\rho l = 2.3 \times 10^{-11}$ ohm cm^2 along the c axis. A.

537.311.31

7902. ELECTRICAL RESISTANCE OF IRON, NICKEL AND NICKEL–COPPER ALLOYS AT LOW TEMPERATURES.
E.I.Kondorskiĭ, O.S.Galkina and L.A.Chernikova.
Zh. éksper. teor. Fiz., Vol. 34, No. 5, 1070-6 (1958). In Russian.

The electrical resistivity of nickel, iron and of copper alloys of nickel containing up to 25% of copper was measured in the temperature interval from 2 to 78°K. Assuming the two-thirds-law to hold for the temperature dependence of the spontaneous magnetization I_S, it is easy to find the relation between the electrical resistivity ρ and concentration of the ferromagnons $n = 1 - I_S/I_0$ (where I_0 is the magnetization for $T \to 0°$) and to obtain a numerical value of the coefficient $(\rho - \rho_0)/n$, where ρ_0 is the residual resistivity. Comparisons of this coefficient for nickel with $\Delta\rho/\Delta n$ ($\Delta\rho$ and Δn are changes in ρ and n due to changes of the true magnetization in strong magnetic fields) shows that the compared quantities are close to each other. This can be considered as an indirect proof of correctness of the assumption that the resistance of ferromagnetic metals at low temperatures is related to scattering of electrons on inhomogeneities of magnetic moment of the lattice (scattering on ferromagnons). A.

537.311.31 : 538.632

7903. MEASUREMENTS OF THE HALL EFFECT ON FERROMAGNETIC NICKEL LAYERS. L.Reimer.
Z. Phys., Vol. 150, No. 3, 277-86 (1958). In German.

Measurements of Hall effect R are described on nickel films as a function of magnetic field strength (0-12 000 Oe), temperature of glass substrate (20°-400°C), and thickness (110-2000 A), and also on compact material. The field dependence of R is found to be similar to that of magnetoresistance. The ferromagnetic effects are separated from the normal magnetic effects when the results are analysed. C.A.Hogarth

537.311.31 : 537.323

7904. THE ELECTRICAL PROPERTIES OF THE SYSTEM TIN–ANTIMONY. V.I.Ust'yanov.
Zh. tekh. Fiz., Vol. 28, No. 6, 1190-4 (1958). In Russian.

The conductivities σ, Hall constants R, and thermoelectric powers α of five alloys made from purified Sn and Sb in the range 55-65 weight per cent Sn were measured (R at 25°C; α and σ, 25°-330° C). Some of the alloys were two-phase. Values of α up to 100 μV/deg C were obtained. The number of carriers/cm^3 ($\sim 3 \times 10^{20}$ electrons) diminished linearly with increasing Sb concentration. A qualitative interpretation of the results was attempted. K.F.Hulme

537.311.31 : 539.231 : 538.221

RESISTANCE AT VARIOUS TEMPERATURES OF SPUTTERED NICKEL FILMS. See Abstr. 7174

537.311.32 : 539.89

7905. ELECTRICAL CONDUCTIVITY OF SULPHUR UNDER THE ACTION OF A SHOCK WAVE. S.Joigneau and J.Thouvenin.
C.R. Acad. Sci. (Paris), Vol. 246, No. 25, 3422-5 (June 23, 1958). In French.

When very high pressures are applied to a sulphur specimen it develops appreciable conductivity, which increases rapidly with pressure. A technique is described for obtaining momentarily high pressures by exploding a cartridge which has the specimen holder attached to its base. It is suggested that at an extremely high pressure the resistivity would reach a minimum value, corresponding to a pure metallic form of sulphur. C.Hilsum

537.311.32

7906. ELECTRICAL CONDUCTIVITY OF X-IRRADIATED NaCl.
R.W.Christy and W.E.Harte.
Phys. Rev., Vol. 109, No. 3, 710-15 (Feb. 1, 1958).

The electrical resistance of Harshaw sodium chloride crystals exposed at room temperature to X-ray doses sufficient to produce about 6×10^{16} F-centres/cm^3 was measured as a function of time at constant temperatures between 159° and 200°C. The effects of previous heat treatment of the crystals, X-ray dose, temperature of measurement, and preliminary optical bleaching were observed. Initially the resistance of irradiated crystals is much greater than that of unirradiated ones. The resistance of the coloured crystals at first decreases rapidly (for about 10 to 100 min, depending on the temperature). In the case of crystals used as received from Harshaw, the resistance even falls slightly below that of the normal uncoloured crystals. Subsequently the resistance again increases, reaching a constant value (after about 50 to 1000 min) higher than for the normal crystal. If the crystals are optically bleached before the measurement, the resistance increase recovers very much more slowly. The behaviour can be restored to normal by annealing above 250°C. The slow resistance increase is seen as evidence for the production by the X-rays of excess positive-ion vacancies. A.

537.311.33

7907. ALL-UNION CONFERENCE ON THE THEORY OF SEMICONDUCTORS. M.F.Deĭgen, I.M.Dykman and K.B.Tolpygo.
Zh. tekh. Fiz., Vol. 27, No.7, 1628-42 (1957). In Russian.

Summaries of the 40 papers read in Kiev from 9 to 13 October, 1956. The subjects dealt with were: many-electron theory of the solid state; exciton processes in semiconductors; the interaction of carriers with the lattice; the theory of polarons; the theory of local states of electrons in semiconductors; zone structure; magnetic properties of semicomductors; the phenomenological theory of semiconductors. Metallurgical Abstracts

537.311.33

7908. FURTHER DEVELOPMENT OF THE THEORY OF SEMICONDUCTORS. A.F.Ioffe.
Zh. tekh. Fiz., Vol. 27, No. 6, 1153-60 (1957). In Russian.

A survey and analysis of the many successful attempts at theoretical representations of individual features of certain types of semiconductors which still remain to be unified, and amplified, before a general theory of semiconductors can emerge. However, it is already possible to separate characteristics pertaining only to certain ranges and types from those common to all types, i.e. to semiconductors as such. The complete theory will closely relate physical and chemical phenomena.
Electrical Research Association

537.311.33

7909. EXCITED STATES OF AN ATOMIC SEMICONDUCTOR ON THE MANY-ELECTRON MODEL.
S.V.Vonsovskiĭ and A.N.Kushnirenko.
Fiz. Metallov i Metallovedenie, Vol. 5, No. 3, 395-401 (1957). In Russian.

The theory of non-current carrying excitations (Frenkel excitons) and current carrying excitations (electrons and holes) is discussed on the basis of a many-electron model of an intrinsic semiconductor with two valence electrons per atom. A.F.Brown

537.311.33 : 539.2

7910. CRITERIA FOR A SEMI-METALLIC STATE OF A SUBSTANCE ON THE MANY-ELECTRON MODEL.
E.N.Agafonova and N.P.Kontorovich.
Fiz. Metallov i Metallovedenie, Vol. 5, No. 3, 402-5 (1957). In Russian.

One-electron theories of the semi-metallic state observed in some doped semiconductors are beiefly reviewed. None give any criterion by which the appearance of a semi-metallic state can be predicted from a knowledge of the properties of an arbitrary semi-

conductor and dope. On the many-electron model, however, a semimetallic state is shown to be a necessary consequence of the satisfaction of an inequality involving energies of electron interaction and electron excitation. A.F.Brown

537.311.33

7911. THE BEHAVIOUR OF THE GERMANIUM-TYPE VALENCE SEMICONDUCTORS IN STRONG ELECTRIC FIELDS. V.A.Chuenkov.
Zh. tekh. Fiz., Vol. 28, No. 3, 470-9 (1958). In Russian.

An attempt is made to analyse the effect of a high electric field E on the electron mobility μ. The results of a mathematical analysis based on the kinetic equation show that up to a certain value of $E = E_1$, μ does not depend on E. When $E_1 > E > E_2$, $\mu \propto 1/\sqrt{E}$. In a very strong $E > E_2$, $\mu \propto 1/E$. The values calculated from expressions derived are in good agreement with the experimental data quoted in the literature. (In the examples quoted, $E_1 = 890$ V/cm, $E_2 = 3.8 \times 10^3$ V/cm.) M.H.Sloboda

537.311.33

7912. ON THE THEORY OF KINETIC PHENOMENA IN A SEMICONDUCTOR WITH A NARROW IMPURITY ZONE. V.M.Nitsovich.
Zh. tekh. Fiz., Vol. 28, No. 6, 1201-6 (1958). In Russian.

Formulae are derived for the Hall constant R, resistivity ρ and thermoelectric power. The impurity atoms are considered to lie at the corners of a simple cubic "superlattice". By adjusting the width of the impurity band and the interaction energy of two electrons on a single impurity atom, and taking into account the existence of compensating impurities, it was possible to obtain reasonable agreement with the data on ρ and R presented by Fritzsche (Abstr. 7954/1955) in the range 3° - 10°K. K.F.Hulme

537.311.33

7913. EFFECT OF CRYSTAL LATTICE VIBRATIONS ON ELECTRON–HOLE PAIR PRODUCTION IN A STRONG ELECTRIC FIELD. L.V.Keldȳsh.
Zh. éksper. teor. Fiz., Vol. 34, No. 4, 962-8 (1958). In Russian.

The probability for electron–hole production in a semiconductor located in a strong electric field is calculated taking into account the interaction between the electrons and phonons. A temperature dependence of the effect is obtained which is very appreciable at low temperatures. A qualitative study is made of other processes which may influence the probability of leaking of a valency electron into the conductivity zone. These processes are absorption of several phonons, collisions with a slow (non-ionizing) conductivity electron or an impurity. It is pointed out that the first of these processes may be decisive in relatively weak fields. A.

537.311.33 : 621.315.59

7914. ON AVALANCHE MULTIPLICATION IN SEMICONDUCTOR DEVICES. H.L.Armstrong.
J. Electronics and Control, Vol. 5, No. 2, 97-104 (Aug., 1958).

Recently, evidence has been presented to show that the ionization coefficients for holes and electrons in semiconductors have much the same form as functions of field strength, as do the ionization coefficients in a gas discharge. On this basis, the current multiplication and resulting characteristics have been calculated for the depletion regions of several kinds of junctions, and the results are seen to be similar to those found empirically. The behaviour of breakdown voltage, e.g. as a function of doping density in an abrupt junction, has been calculated, and it is shown that the breakdown voltage varies less quickly than inversely with doping density. This multiplication, due to avalanching in an undepleted semiconductor carrying very large currents, is investigated, and it is found that the current–voltage characteristic should be similar to that observed for multiplication in depletion regions. A.

537.311.33

7915. LOW-FIELD MOBILITY OF CARRIERS IN NONDEGENERATE SEMICONDUCTORS.
M.S.Sodha and D.B.Agrawal.
Canad. J. Phys., Vol. 36, No. 6, 707-10 (June, 1958).

Gunn's theory of the low-field variation of carrier mobility has been extended, using Morgan's analysis, to include the effect of scattering by a single optical mode of lattice vibrations. Numerical results obtained for n-germanium show that there is still a serious disagreement between theory and experiment. A.

537.311.33 : 621.315.59 : 621.317.61

7916. DRIFT MOBILITY MEASUREMENTS. M.Green.
J. appl. Phys., Vol. 28, No. 12, 1473-8 (Dec., 1957).

Measurements of drift mobility were made by observing the transit time t of a pulse of charge carriers over the distance x between the point of photo-injection and a "point of detection". The detector point may be a reverse biased junction, a constriction in the cross-sectional area, a point contact electrode, or other electrically indicating semiconductor construction. The arrival of the injected pulse at the detector results in a relatively large change in the conductance of the specimen. A signal taken from a load resistor in series with the sample is observed on the c.r.o. The time t is plotted against x. The reciprocal slope of the curve gives pulse drift velocity which when divided by the field strength E(x) gives the corresponding mobility $\mu(x)$. For a junction, electron mobility is determined by injection in the p-region; hole mobility is determined by injection in the n-region. A.

537.311.33 : 538.632

7917. VARIATION OF HALL MOBILITY OF CARRIERS IN NONDEGENERATE SEMICONDUCTORS WITH ELECTRIC FIELD.
M.S.Sodha and P.C.Eastman.
Phys. Rev., Vol. 110, No. 6, 1314-16 (June 15, 1958).

An expression was obtained for Hall mobility applicable in a large range of fields and non-Maxwellian distribution of velocities of carriers. This expression, together with the velocity distribution of carriers in the presence of the field, obtained by Yamashita and Watanabe (Abstr. 3722/1955), was used for the theoretical investigation of the variation of Hall mobility with electric field. A.

537.311.33 : 538.63

7918. THE VALUE OF THE HALL CONSTANT IN SEMICONDUCTORS FOR STRONG MAGNETIC FIELDS. Yu.A.Firsov.
Zh. tekh. Fiz., Vol. 28, No. 6, 1129-39 (1958). In Russian.

Expressions are derived valid for $u\mathrm{H}/c \gg 1$, $\mu\mathrm{H}/kT > \sim 1$, where u is the carrier mobility and μ the Bohr magneton. The quantization of the electronic motion in the magnetic field is taken into account; the results obtained are independent of the carrier scattering mechanism. It is shown that a study of the angular dependence of the Hall constant in strong magnetic fields enables one to deduce whether the zones overlap, and if the constant energy surfaces in momentum space consist of several ellipsoids, to find all the tensor components of effective mass and the relative position of the extrema. K.F.Hulme

537.311.33 : 538.632

7919. APPARATUS FOR MEASUREMENT OF THE HALL EFFEC IN SEMICONDUCTORS. V.N.Bogomolov and V.A.Myasnikov.
Zh. tekh. Fiz., Vol. 27, No. 6, 1209-14 (1957). In Russian.

Of the three known methods of measuring the Hall effect: with constant electric and magnetic fields, constant magnetic field and a.c., and alternating field and current, respectively, the last has the greatest advantages and was chosen by the authors. The frequencies of current, field and measured Hall e.m.f. were 75, 50 and 25, respectively. The generator and field frequencies were synchronized to reduce the fluctuations of the Hall e.m.f. The apparatus is described in detail. Electrical Research Association

537.311.33

7920. SWEEP-OUT EFFECTS IN THE PHASE SHIFT METHOD OF CARRIER LIFETIME MEASUREMENTS.
N.B.Grover and E.Harnik.
Proc. Phys. Soc., Vol. 72, Pt 2, 267-9 (Aug., 1958).

The end effects due to the finite length of semiconductor filament are calculated for sinusoidally modulated illumination. It is shown how lifetime values may be corrected for these effects, both with full illumination of the filament and with only a narrow strip illuminated. K.W.Plessner

537.311.33

7921. MEASUREMENT OF THE CHARGE-CARRIER LIFETIME IN SEMICONDUCTORS.
M.I.Iglitsȳn, Yu.A.Kontsevoĭ, V.D.Kudin and A.A.Meler.
Zh. tekh. Fiz., Vol. 27, No. 7, 1414-24 (1957). In Russian.

Theoretical and experimental analysis of the method of modulating the conductivity of a point contact proved its suitability for measuring the lifetime of minority carriers and its advantages over the other well-known methods. The formulae derived consider diffusion and recombination at the contact. The relation between measured values of the lifetime and the parameters of the injecting pulse was studied and the conditions for correct measurements were established. Electrical Research Association

537.311.33

7922. MEASUREMENT OF THE CHARGE-CARRIER LIFETIME IN MONOCRYSTALLINE SILICON.
M.I.Iglitsȳn, Yu.A.Kontsevoĭ and V.D.Kudin.
Zh. tekh. Fiz., Vol. 27, No. 7, 1425-30 (1957). In Russian.

The method of measuring the charge-carrier lifetime in mono-

crystalline silicon, based on a measurement of the modulated conductivity in the region of a point contact during the passage of two successive current pulses, is described. The results obtained are compared with the diffusion lengths found by the photoelectric method. The temperature dependence of the carrier lifetime carriers was also investigated. The results agree well with Shockley and Read's recombination theory. Electrical Research Association

537.311.33

7923. RECOMBINATION OF EXCESS CARRIERS IN SEMICONDUCTORS. J.Okada.
J. Phys. Soc. Japan, Vol. 12, No. 12, 1338-44 (Dec., 1957).

A model is discussed in which the recombination occurs through multiple-levels. The theory is extended to apply to germanium. The dependence of carrier lifetime on temperature in the majority of pure n-type germanium samples can be explained by introducing two sets of traps: recombination centres ($E_C - E_r = 0.30$ eV) and hole trapping centres ($E_t - E_V = 0.30$ eV). However, the minority carrier lifetime of samples containing comparatively high dislocation-density (10^4-10^5/cm^2) is shown to vary with the dislocation density, and the results are expressed in terms of two lifetimes: τ_d, associated with random dislocations; and τ_b, due to the recombination centres of an undetermined origin. It is also shown that anomalous temperature dependence of the steady-state photoconductivity of high-resistivity p-type nickel-doped germanium can be interpreted by assuming that two acceptor levels of nickel atom are effective at the same time, but different in the effect on the recombination process. A.

537.311.33

7924. TRANSIENT RECOMBINATION OF EXCESS CARRIERS IN SEMICONDUCTORS. G.K.Wertheim.
Phys. Rev., Vol. 109, No. 4, 1086-91 (Feb. 15, 1958).

The recombination equations for a system containing an arbitrary number of Shockley–Read recombination centres are formulated. Transient solutions are obtained for the decay following the injection of a pulse of carriers into a system containing one or two centres. The specific cases considered include: (1) the simple one-centre case, which enables one to discuss (a) the situation for a large injection of carriers, (b) recombination through donors in n-type or acceptors in p-type material, and (c) recombination through centres in the presence of direct recombination; (2) the case of a recombination centre with a temporary trap; and (3) the case of two recombination centres. A.

537.311.33

7925. ON DETERMINING THE RELAXATION TIMES OF SURFACE STATES IN GERMANIUM. A.É.Yunovich.
Zh. tekh. Fiz., Vol. 27, No. 8, 1707-12 (1957). In Russian.
English translation in: Soviet Physics — Technical Physics (New York), Vol. 2, No. 8, 1587-92 (Aug., 1957).

A method is described for investigating the effect of an external electric field upon the electrical conductivity of a semiconductor and upon the variation of this effect as a function of frequency. The method depends upon measuring the d.c. component of the voltage across the specimen; this component arises due to the action of the transverse electric field, which has the same frequency as the a.c. current flowing through the specimen. The results of the measurement of the effect of the field in the frequency range from 4×10^2 to 3×10^4 c/s on specimens of n-type germanium prove the strong dependence of the relaxation times of the surface states upon the surrounding atmosphere. A.

537.311.33

7926. FREQUENCY DEPENDENCE OF THE FIELD EFFECT IN SEMICONDUCTORS. A.É.Yunovich.
Zh. tekh. Fiz., Vol. 28, No. 4, 689-93 (1958). In Russian.

Theoretical. The kinetics of trapping by the surface states in semiconductors under the influence of an external, sinusoidal electric field are discussed. Expressions showing the variation of conductivity and effective carrier mobility with the field frequency are derived for the case when current carriers of one sign predominate, and when near-equilibrium conditions exist in the body of the semiconductor. The theoretical effective mobility/frequency relationship is in quantitative agreement with the results of the author's earlier investigation (see preceding abstract). It is shown that from the data on the frequency dependence of the field-effect trap-density, trap energy state, relaxation time and the capture cross-section of traps can be determined. M.H.Sloboda

537.311.33

7927. ON THE THEORY OF THE FIELD EFFECT.
V.L.Bonch-Bruevich.
Zh. tekh. Fiz., Vol. 28, No. 1, 70-6 (1958). In Russian.

Starting from the equations of Boltzmann and Poisson, the influence of a transverse alternating electric field on the longitudinal electrical conductivity of a thin semiconductor specimen is considered. It is shown that the frequency dependence of the effect reduces to that obtained by Yunovich (see preceding abstract) when the surface recombination centres are considered to be distributed in a depth $L \ll l$, where l is the mean free path. If $L \sim l$ the frequency dependence can be more complicated. K.F.Hulme

537.311.33 : 538.632

7928. ISOTROPIC APPROXIMATION TO THE MAGNETORESISTANCE OF A MULTIVALLEY SEMICONDUCTOR.
R.W.Keyes.
Phys. Rev., Vol. 109, No. 1, 43-6 (Jan. 1, 1958).

The magnetoconductivity tensor for a single valley is averaged over all orientations of the valley, giving an isotropic magnetoconductivity tensor. The valley anisotropy can be deduced from the magnetoresistance coefficients of such a model. It is suggested that this model will describe approximately the magnetoresistance phenomena of a polycrystalline multivalley semiconductor. It is also shown that the results of the calculation provide a means for determining the valley anistropy of a multivalley semiconductor from magnetoresistance data without the use of a detailed model of the band structure. A.

537.311.33 : 538.61

7929. ON THE THEORY OF THE TRANSVERSE PHOTOMAGNETIC EFFECT. B.Ya.Moĭzhes and Yu.N.Obraztsov.
Zh. tekh. Fiz., Vol. 27, No. 7, 1446-53 (1957). In Russian.

The theory of the transverse photomagnetic effect in semiconductors discovered by Kikoin and Bykovskii (Abstr. 1283/1957) is considered; the effect is at right angles to the usual photomagnetic effect, and is present when the magnetic field has a component normal to the illuminated surface of the semiconductor. The behaviour of p-type Ge, where the voltage changes sign on increasing the magnetic field, can be explained if ~ 1.5% of the holes have a mobility ~10 times the average hole mobility. The behaviour of the short-circuited transverse photomagnetic current is a more sensitive indication of the presence of such "light" holes.

Metallurgical Abstracts

537.311.33 : 621.315.59 : 621.376

7930. INFRA-RED AND MICROWAVE MODULATION USING FREE CARRIERS IN SEMICONDUCTORS. A.F.Gibson.
J. sci. Instrum., Vol. 35, No. 8, 273-8 (Aug., 1958).

A description of the classical Drude–Zener theory of the dielectric constant and conductivity of a conductor is given, with particular reference to germanium and other semiconductors. The degree of agreement between theory and experiment is indicated. Methods whereby the conductivity of a semiconductor may be modulated and the application of these techniques to the study of the optical and microwave properties of semiconductors are described. A.

537.311.33 : 539.214

LIGHT-INDUCED PLASTICITY IN SEMICONDUCTORS. See Abstr. 7528

537.311.33 : 535.343

7931. STUDIES ON GROUP III-V INTERMETALLIC COMPOUNDS.
C.Kolm, S.A.Kulin and B.L.Averbach.
Phys. Rev., Vol. 108, No. 4, 965-71 (Nov. 15, 1957).

A study was made of the properties of the compounds GaAs and InSb alloyed with Si, Ge, Sn and Pb; the quasi-binary InSb–GaSb was also investigated. Lattice parameter, infrared absorption, and electrical resistivity measurements were made. The forbidden energy gaps of the GaAs alloys were found to vary inversely with the spacing, with the one exception of the GaAs–Ge alloy, where the reverse effect was observed. On the basis of the infrared transmission and electrical resistivity data it was concluded that the Group IV elements substituted for nearest-neighbour pairs in GaAs, but in the case of Si and Ge in InSb it appeared that the substitution of only one atom in the unit polyhedron occurred. A.

537.311.33

7932. DEPENDENCE OF THE IONIC CONDUCTIVITY OF AgBr ON ITS PREVIOUS HISTORY. M.Höhne.
Ann. Phys. (Leipzig), Vol. 20, No. 7-8, 412-24 (1957). In German.

The a.c. and d.c. conductivity of oxygen-doped crystals, both quenched and annealed, is measured in the temperature range 20-200°C and compared with results on plastically deformed, sulphur- and selenium-doped specimens. Two possible causes of the time-dependent conductivity are discussed: a change in mobility and a non-equilibrium concentration of current carriers.

J.E.Caffyn

537.311.33

7933. ELECTRICAL PROPERTIES OF Ag_2Te. S.Miyatani.
J. Phys. Soc. Japan, Vol. 13, No. 4, 341-50 (April, 1958).

The electronic conductivity, σ_e, Hall constant, R, and thermoelectric power, Θ, in αAg_2Te are measured as the Ag/Te ratio is varied by the use of the galvanic cell Ag|AgI|Ag_2Te|Pt, where the e.m.f. of the cell, E, represents the position of the Fermi level relative to Ag-saturated Ag_2Te. According as Ag is removed across the cell, starting from the Ag-saturated composition, σ_e decreases at first, and then increases. Θ changes its sign at the minimum of σ_e, although R is always n-type, due to the large mobility ratio (~ 100). The energy gap is, therefore, as narrow as several kT. When Ag is removed further, σ_e decreases again, keeping E constant. This is a mixed state of Ag_2Te and a new phase mentioned below. After a minimum of σ_e is attained, σ_e and E increase again, suggesting a new phase, $Ag_{\sim 1.99}Te$. The energy gap of this phase is larger than that in the Ag_2Te phase and the electron and hole mobilities are far smaller than those in Ag_2Te. When Ag is removed still further, σ_e and E become independent of the composition, indicating the precipitation of Te or Te rich compound. These experimental data are compared with the Lorentz–Sommerfeld theory, proving good accordance. Ionic conductivity is estimated from the ionic polarization effect. A.

537.311.33 : 537.323

7934. INVESTIGATION OF THE ELECTRICAL AND THERMOELECTRIC PROPERTIES OF ALUMINIUM ANTIMONIDE.
D.N.Nasledov and S.V.Slobodchikov.
Zh. tekh. Fiz., Vol. 28, No. 4, 715-24 (1958). In Russian.

Electrical conductivity σ, Hall effect R and thermo-e.m.f. of single crystals and of polycrystalline specimens were measured over wide temperature intervals (78-1200°K for σ and R, 140-1250°K for thermo-e.m.f.). From the temperature dependence of σ the forbidden bandwidth was determined as 1.57 eV. Existence of the impurity level at 0.77 eV was inferred from the results of the thermo-e.m.f. measurements, which were also used for calculating the location of the Fermi level. At room temperature the hole mobility (u) was 150-240 $cm^2/(V\ sec)$, the hole/electron-mobility ratio being near unity. Within the entire investigated temperature range the variation of u follows the law

$$1/u = a\,T^{5/2} + b\,T^{-3/2},$$

while above 250°K, $u = a\,T^{-3/2}$. The effective mass of holes between 400° and 700°K, calculated from the Pisarenko formula, was $m_p = (0.9 \pm 0.1)m_0$. M.H.Sloboda

537.311.33 : 536.212.2

7935. ELECTRICAL AND THERMAL PROPERTIES OF Bi_2Te_3.
C.B.Satterthwaite and R.W.Ure, Jr.
Phys. Rev., Vol. 108, No. 5, 1164-70 (Dec. 1, 1957).

Samples of both n-type and p-type Bi_2Te_3 containing from 3×10^{17} to 5×10^{19} extrinsic carriers were prepared and the phase diagram in the region about Bi_2Te_3 was clarified. The Hall mobility parallel to the cleavage planes varies as $T^{-1.5}$ for holes and $T^{-2.7}$ for electrons. Room temperature values are $\mu_p = 420\ cm^2\ V^{-1}\ sec^{-1}$ and $\mu_n = 270\ cm^2\ V^{-1}\ sec^{-1}$. The energy gap is $E_g = 0.20$ eV. From thermal conductivity measurements over the temperature range from 77° to 380°K the lattice conductivity was found to be $\kappa_L = 5.10\times \times 10^{-2}/T\ W\ deg^{-1}\ cm^{-1}$. The sharp rise in the thermal conductivity in the vicinity of room temperature was attributed to transport of energy by ambipolar diffusion of electrons and holes. A.

537.311.33 : 538.66

7936. A STUDY OF THE NERNST–ETTINGHAUSEN EFFECT IN BISMUTH TELLURIDE. R.I.Bashirov.
Zh. tekh. Fiz., Vol. 28, No. 5, 986-9 (1958). In Russian.

The Nernst–Ettinghausen fields, Hall constants, and electrical conductivities of specimens cut from ingots or made by pressing were measured (120-600°K). Three n-type ($1.5\text{-}5.5\times 10^{19}$ carriers/cm^3) and two p-type ($0.4\text{-}6.0\times 10^{19}$ carriers/cm^3) specimens were studied. A magnetic field of 7400 Oe was used. The low-temperature values of the Nernst–Ettinghausen field agreed with expectations based on acoustic-mode lattice-scattering of carriers, although the Hall mobility varied as $T^{-2.3}$ instead of the the expected $T^{-1.5}$. At higher temperatures (above 250-350°K) the specimens became intrinsic. K.F Hulme

537.311.33 : 538.632

7937. THE ELECTRICAL PROPERTIES OF Ga As AT LOW TEMPERATURES. O.V.Emel'yanenko and D.N.Nasledov.
Zh. tekh. Fiz., Vol. 28, No. 6, 1177-87 (1958). In Russian.

Measurements were made on the Hall constant, R, electrical conductivity, σ, and transverse magnetoresistance, $\Delta\rho/\rho_i$ (in magnetic fields, H, up to 25000 Oe) for temperatures 1.5° to 300°K; the thermoelectric power α was also measured (120°-700°K) The four specimens studied were n-type (4×10^{17} to 3×10^{18} electrons per cm^3); two were polycrystalline and two single-crystal. The value of α varied almost linearly with temperature from $-30\ \mu V/°K$ at 120°K to $-170\ \mu V/°K$ at 700°K. Both R and σ were almost temperature independent; using the value of the effective electron mass, m_n, consistent with the α data ($0.03\times$ free electron mass), it is shown that these facts necessarily lead to the conclusion that the ionization energy of the impurities cannot be finite and must be zero; the Fermi level is ~ 0.07 eV above the conduction band edge for all temperatures up to 300°K. It is pointed out that in certain other semiconductors in which the electron gas is degenerate due to small m_n and heavy doping, the impurity ionization energy must also be zero. The temperature independence of the Hall mobility showed that lattice scattering was inoperative. Above $\sim 60°K$, $\Delta\rho/\rho \propto H^2$ and was positive, but below 60°K, for small H, $\Delta\rho/\rho$ was negative — becoming positive at higher H. This behaviour was independent of the illumination, nature of electrodes, surface condition (etched or mechanically polished), surface/volume ratio, direction of H (always transverse), and whether the specimen was cooled by gas or liquid; no explanation of the anomaly could be offered. K.F.Hulme

537.311.33

7938. SOME EXPERIMENTS ON THE SURFACE FIELD EFFECT IN GERMANIUM SINGLE CRYSTALS. M.Kikuchi.
J. Phys. Soc. Japan, Vol. 12, No. 7, 756-62 (July, 1957).

From the combined measurements of the field effect on the surface conductance G and on the surface recombination velocity s, it was found that φ_s (the difference between the Fermi level and the middle of the energy-gap at the surface) drifts towards a negative value when the surface is kept in room air after being submitted to CP-4 etching fluid. This drift was accompanied by a gradual growth of oxide layer on the surface, which was checked by the observation of the relaxation effect. It is suggested that $s-\varphi_s$ curves calculated by Stevenson and Keyes (Abstr. 3761/1955) must be shifted to the right by 0.1-0.2 V. A

537.311.33 : 621.315.59

7939. ON THE HOT ELECTRON EFFECT IN n-TYPE GERMANIUM. R.Stratton.
J. Electronics and Control, Vol. 5, No. 2, 157-161 (Aug., 1958).

The variation of the mobility with an applied electric field is calculated on the assumption that inter-electronic collisions are predominant. The scattering of electrons by acoustic and by non-polar optical modes of lattice vibrations is considered without the restriction, previously imposed, that the latter is only effective when the mean electron energy is greater than the phonon energy. Good agreement between the theory and experiments is obtained without the use of arbitrary parameters. A

537.311.3

7940. THE DIFFUSION CONSTANT, MOBILITY AND LIFETIME OF MINORITY CARRIERS IN GERMANIUM CONTAINING PARALLEL ARRAYS OF DISLOCATIONS.
J.B.Arthur, A.F.Gibson, J.W.Granville and E.G.S.Paige.
Phil. Mag. (Eighth Ser.), Vol. 3, 940-9 (Sept., 1958).

The presence of a high density of parallel edge dislocations in n-type germanium is found to significantly enhance the diffusion of holes in a direction parallel to the dislocations. The apparent diffusion constant is therefore anisotropic. In p-type germanium on the other hand the diffusion constant is isotropic and the carrier lifetime anisotropic. At high electric fields the drift mobility of holes in n-type germanium is found to be anisotropic with respect to the dislocation array, no comparable effect occurring in p-type material. These results can be explained by a model which assumes that dislocations introduce an additional acceptor level approximately intermediate in energy between the conduction and valence energy bands. A

537.311.3

7941. AN INTERPRETATION OF CERTAIN TRANSPORT PROPERTIES IN GERMANIUM CONTAINING PARALLEL ARRAYS OR EDGE DISLOCATIONS. A.F.Gibson and E.G.S.Paige.
Phil. Mag. (Eighth Ser.), Vol. 3, 950-60 (Sept., 1958).

An interpretation is given of the anisotropic effects observed by Arthur et al. (see preceding abstract) in germanium containing parallel arrays of edge dislocations. The anisotropy of the diffusion constant and high field mobility in n-type crystals is considered quantitatively. The diameter of the space-charge

cylinder surrounding the dislocations (1.6×10^{-4} cm) and the fraction of time an injected hole spends within the space-charge region ($\frac{1}{2}$) is deduced from the analysis. A.

537.311.33 : 538.63

7942. RELAXATION TIME ANISOTROPY IN N-TYPE GERMANIUM. C.Goldberg.
Phys. Rev., Vol. 109, No. 2, 331-5 (Jan. 15, 1958).

The anisotropy parameter $K = K_m/K_\tau = (m_\parallel/m)(\tau_\parallel/\tau)^{-1}$ is determined from magnetoconductance measurements in the temperature range from 45° to 300°K. If one uses the cyclotron resonance value for the mass ratio K_m, the magnetoconductance measurements give $K_\tau = 1.0$ for lattice scattering and $K_\tau > 1$ for moderate amounts of impurity scattering. For strong impurity scattering, the data show that the scattering cannot be represented by a simple relaxation-time tensor model. A.

537.311.33

7943. TEMPERATURE DEPENDENCE OF POINT CONTACT INJECTION RATIO IN GERMANIUM. D.Gerlich.
Proc. Phys. Soc., Vol. 72, Pt 2, 264-7 (Aug., 1958).

The injection ratio, γ, is measured by a bridge method using repetitive square-pulses as the exciting voltage. The variation of γ with current for p-type samples is at variance with theory. As regards the temperature dependence of γ, very different curves have been obtained for apparently similar samples, and the extreme sensitivity of γ to surface condition is pointed out, no adequate theory being available to date. K.W.Plessner

537.311.33

7944. THE THERMAL CONVERSION OF GERMANIUM BY IRRADIATION WITH ELECTRONS.
L.A.Balabanova and M.M.Bredov.
Zh. tekh. Fiz., Vol. 27, No. 7, 1401-7 (1957). In Russian.

The authors studied the changes in electrical properties of Ge specimens caused by heating in vacuo. The heat was generated and conveniently controlled by bombardment with electrons (up to 10 keV energy). Before and after heating, the density of current carriers (holes or electrons) was measured, as well as the lifetime, τ, of minority carriers. The density of thermal acceptors produced in the specimens at first increased with time of heating, but attained a constant value after several minutes; the saturation value, N, depended on the source of the Ge used but not on the conditions of heating (temperature was not measured); typically, N was 5×10^{15} cm^{-3}. If Cu was dusted on the specimen before heating, N was increased by ~ 50%; if the specimen surfaces were etched in C.P. 4 and rinsed in warm, distilled water (instead of the usual treatment of grinding followed by rinsing in alcohol), N was decreased by 25-50%. Only small inhomogeneities in the electrical properties were observed, even after short heating periods (30 sec). It was concluded that the thermal acceptors do not diffuse in from the surface on heating but are already present in the material and change from a latent state to an active one. From the experimental fact that $\tau \propto 1/N$, the recombination cross-section of the thermal acceptors was found to be $\sim 5 \times 10^{-17}$ cm^2. Metallurgical Abstracts

537.311.33

7945. THE SCATTERING OF HOLES AND ELECTRONS IN GERMANIUM AND SILICON. G.E.Pikus.
Zh. tekh. Fiz., Vol. 27, No. 7, 1606-9 (1957). In Russian.

The author describes a theoretical analysis of the transitions of holes between "light" and "heavy" states in the valence bands of Ge and Si. Under certain assumptions, it is found that the relaxation times for both types of holes are equal, and that transitions are quite probable at each act of the scattering process. This agrees with cyclotron-resonance data and the failure to observe experimentally different drift velocities for the two types of hole.
Metallurgical Abstracts

537.311.33 : 538.63

7946. GALVANOMAGNETIC EFFECTS IN N-TYPE GERMANIUM AND SILICON SINGLE CRYSTALS FOR STRONG MAGNETIC FIELDS. M.I.Klinger and P.I.Voronyuk.
Zh. tekh. Fiz., Vol. 27, No. 7, 1609-13 (1957). In Russian.

The effective number of conduction electrons, N, the Hall constant, R, and the magnetoresistance constant, ρ_H, are calculated, neglecting impurity scattering, but taking into account the anisotropy of the effective mass and the quantization of energy levels in the strong magnetic field. The expressions derived show the anisotropy of N, R, and ρ_H. Metallurgical Abstracts

537.311.33

7947. THE CHANGE OF LIFETIME IN THIN GERMANIUM PLATES UNDER THE INFLUENCE OF AN EXTERNAL ELECTRIC FIELD AND ADSORPTION. V.I.Lyashenko.
Zh. tekh. Fiz., Vol. 27, No. 7, 1613-15 (1957). In Russian.

The lifetimes, τ, were deduced from the photovoltages developed in specimens of varying conductivity. For a voltage, +V, applied to the specimen τ increased; for −V, τ decreased; the changes were ~ 10% at first when 2 kV was applied, but decayed with a time constant of ~ 50 sec. Changes of τ when the specimen surfaces were covered with liquid films (acetone, alcohol, benzene, water, or vaseline) were also observed, with and without applied voltages. The results were interpreted in terms of changes of the surface-recombination rates; it was thought that the similar results for n- and p-type Ge were due to oxide films.
Metallurgical Abstracts

537.311.33 : 539.2

INFLUENCE OF CRYSTAL ORIENTATION ON THE SURFACE BEHAVIOUR OF InSb. See Abstr. 7514

537.311.33 : 539.234

A STUDY OF THIN LAYERS OF CHANGING COMPOSITION IN THE SYSTEM INDIUM–ANTIMONY. See Abstr. 7542

537.311.33

7948. STUDY OF THE SEMI-CONDUCTING PROPERTIES OF PYROLUSITE. J.N.Das.
Z. Phys., Vol. 151, No. 3, 345-50 (1958).

The electrical conductivity σ of the specimens is found to obey a relation of the type $\sigma = C \exp(-B/kT)$ over a temperature range from 300° to 500°K, where C and B are constants. The experimentally determined values of B and C are (1) B ≅ 1490 to 2199 (2) C ≅ 0.72×10^{-3} to 4.9×10^{-3} ohms^{-1} cm^{-1}. The values of the activation energy determined from the values of B are ≅ 0.13 to 0.19 eV. In a.c. measurements σ is found to vary with the voltage applied across the specimen at a given temperature. The I–V characteristics of metal-point semiconductor contacts are non-linear symmetrical curves and are strongly temperature dependent. The value of the Hall constant (−0.14 cm^3/C) yields a carrier concentration of 4.3×10^{19}/cm^3, and mobility of 1.2 cm^2 V^{-1} sec^{-1}. $\Delta\rho/\rho$ for the specimen is found to vary as H^2, where ρ is the resistivity and H the magnetic field. The specimens develop a thermoelectric power of 200 to 500 μV/deg K, which is fairly constant over the temperature range from 300° to 800°K. The sign of the thermo-e.m.f. and of the Hall constant indicate that the specimens are n-type. A.

537.311.33 : 537.312.5

7949. THE SURFACE POTENTIAL OF SELENIUM AND ITS RELATION TO THE RECTIFICATION AND THE PHOTOVOLTAIC EFFECTS. U.Yoshida and A.Suzuki.
J. Phys. Soc. Japan, Vol. 12, No. 5, 459-63 (May, 1957).

The surface potential of selenium was measured by Kelvin's methods and was found to be influenced by ambient conditions. The characteristics of a rectifier obtained by making metal-electrode contact with the selenium surface depend on the surface potential. The variation of the surface potential under illumination is of the same magnitude as the photovoltage of a selenium cell. From these results, it is concluded that a blocking layer is formed on the selenium surface during the heat treatment. A.

537.311.33

7950. CONDUCTIVITY OF X-RAY IRRADIATED AMORPHOUS SELENIUM LAYERS. R.Eppe.
Z. angew. Phys., Vol. 9, No. 6, 261-8 (June, 1957). In German.

By varying the temperature of deposition of the layer reproducible properties were obtained. The effect of X-ray intensity, field strength, layer thickness, electrode material and impurity was investigated. The growth and decay of the photoconductivity and the dark conductivity/temperature dependence were also measured. J.E.Caffyn

537.311.33 : 537.312.5

7951. EFFECT OF IODINE ON THE ELECTRICAL AND PHOTOELECTRIC PROPERTIES OF SELENIUM.
D.N.Nasledov and B.V.Sokolov.
Zh. tekh. Fiz., Vol. 28, No. 4, 704-14 (1958). In Russian.

The following results were obtained from the measurements of various properties of Se containing up to 10 atomic per cent of I: (1) Crystallization of Se is slowed down by I additions < 0.05 – 0.2% and accelerated by additions > 0.2%. (2) Resistivity ρ and activation energy E of specimens subjected to prolonged crystallization at temperatures > 170-180°C decrease with increasing I content, reach the minimum at 0.1% I and then increase again. At 0.1% I ρ is decreased by a factor of 80-300, and E by 0.1 eV. (3) The temperature dependence of ρ obeys the Van Hoff law between −50° and +100°C but not above 100°C, where the temperature coefficient of electrical

resistance sometimes changes its sign. (4) Very small isothermal variation of ρ was observed in specimens containing ~ 0.05% I that had been cooled rapidly from 170–190°C to room temperature. (5) At low I concentrations both photoconductivity and photosensitivity increase with the rising I content, reach the maximum at 0.2 – 0.5% I, and then decrease at the I concentrations 1.5%. (6) Neither the temperature dependence nor the character of the photoconductivity–illumination intensity relationship of pure Se is affected by the addition of I. The observed effects of I on the electrical and photoelectrical properties of Se are explained by a hypothesis according to which the I atoms occupy interstitial positions in the Se crystal lattice at concentrations < 0.1%, and form intercrystalline layers when I concentrations > 0.1%. (This hypothesis is discussed in terms of the theory of H-defects). No explanation is given of the fact that the thermo-e.m.f. of Se is increased and its temperature coefficient decreased by I addition. M.H.Sloboda

537.311.33

7952. LIFETIME IN PULLED SILICON CRYSTALS. C.A.Bittmann and G.Bemski.
J. appl. Phys., Vol. 28, No. 12, 1423-6 (Dec., 1957).

Lifetime data of 46 pulled silicon crystals are interpreted in terms of the Shockley–Read (Abstr. 8183/1952) recombination theory. The data are consistent with the theory under the assumption of a single recombination level and a constant concentration of recombination centres, independent of the resistivity of the crystals. However, it is not possible to distinguish between two possibilities as to the location of the recombination level in the lower or the upper half of the energy gap by this type of experiment. The energy levels thus obtained are at 0.17 eV from the valence band, or 0.20 eV from the conduction band in p-type silicon, and at 0.22 eV from the valence band, or 0.25 eV from the conduction band in n-type silicon. A.

537.311.33

7953. INTERACTIONS BETWEEN OXYGEN AND ACCEPTOR ELEMENTS IN SILICON. C.S.Fuller and F.H.Doleiden.
J. appl. Phys., Vol. 29, No. 8, 1264-5 (Aug., 1958).

The formation of donors by the heat treatment of silicon containing oxygen may arise in part from diffusion-controlled reactions involving oxygen and acceptor elements such as Al, B, and Ga in solution. C.A.Hogarth

537.311.33

7954. ON A TRANSFORMATION OF P-Si INTO N-Si BY α-RAYS. F.Trey and F.Oberhauser.
Naturwissenschaften, Vol. 44, No. 8, 256-7 (1957). In German.

A n-type layer was produced on the surface of a p-type crystal in the vicinity of two adjacent polonium sources. The sign of the free carriers was determined by measurement of the point contact rectification ratio. R.Stratton

537.311.33

7955. PROPERTIES OF SILICON DOPED WITH IRON OR COPPER. C.B.Collins and R.O.Carlson.
Phys. Rev., Vol. 108, No. 6, 1409-14 (Dec. 15, 1957).

Iron introduces a donor level into silicon at 0.40 eV from the valence band observed both in crystals doped in the melt and in crystals into which iron was diffused at 1200°C. This level converts anomalously to a level 0.55 eV from the conduction band on standing at room temperature. The conversion is reversible in the range from about 70° to 200°C; above 200°C, the electrical activity of iron irreversibly disappears. No evidence for acceptor action of iron was found. The electrically active solubility of iron, 1.5×10^{16} cm^{-3} at 1200°C, is higher than the radiotracer solubility, but the former was measured in more rapidly quenched samples. The distribution coefficient is 8×10^{-6}. Preferential trapping of electrons by iron centres was shown by Hall mobility measurements on optically-excited charge carriers. Liftime studies by the photoconductive decay method indicated a larger capture cross-section for electrons than for holes. Copper introduced a donor level at 0.24 eV and an acceptor level at 0.49 eV, both as measured from the valence band. The maximum electrical activity in quenched samples was 5×10^{14} cm^{-3} out of a total concentration of 10^{18} cm^{-3} at 1200°C. Infrared photoconductivity spectra support the position of the deep levels due to iron and copper. The apparent lack of electrical activity or inconsistency in producing a level is discussed for a number of other elements in silicon. Precipitation while cooling from high temperature is believed to reduce the soluble component of most of these elements below the observable limit of ~ 10^{14} cm^{-3}. A.

537.311.33

7956. THERMAL BREAKDOWN IN SILICON P–N JUNCTIONS. J.Tauc and A.Abrahám.
Phys. Rev., Vol. 108, No. 4, 936-7 (Nov. 15, 1957).

It is shown that the normal avalanche breakdown of well-etched silicon p–n junctions can pass at higher temperatures into a kind of thermal breakdown at which most of the current flows through a small hot hole in the potential barrier. A.

537.311.33

7957. BREAKDOWN IN SILICON. B.Senitzky and J.L.Moll.
Phys. Rev., Vol. 110, No. 3, 612-20 (May 1, 1958).

The voltage–current, light multiplication, and small-signal a.c. impedance characteristics of reverse-biased silicon p-n junctions are studied in the breakdown region. Two types of junction are considered: a uniform diffused junction, and an alloyed junction specifically designed to contain only one region of localized breakdown (microplasma). The results for the single-microplasma junction are as follows: (1) the voltage–current characteristic, which describes the relations existing during the instant the microplasma is on, consists of a negative-resistance unstable region and a positive-resistance stable region; (2) the multiplication characteristic indicates that the junction is most sensitive to light in the unstable breakdown region; (3) the small-signal a.c. impedance characteristi exhibits an inductive component of current in the unstable breakdow region. The single-microplasma junction V–I characteristic is compared with a previous theoretical prediction which discusses the mechanisms underlying the properties of a microplasma; an explanation of the multiplication and impedance characteristics of the single-microplasma junction in terms of these properties is indicated; and lastly, the behaviour of a uniform junction, which contains many microplasmas, is explained in terms of the results obtained with a single-microplasma junction. A.

537.311.33

7958. THE ELECTRICAL CONDUCTIVITY AND HALL EFFECT OF SILICON. E.H.Putley and W.H.Mitchell.
Proc. Phys. Soc., Vol. 72, Pt 2, 193-200 (Aug., 1958).

The electrical conductivity and Hall effect were measured over the temperature range 20°K to 500°K on single crystals of silicon with extrinsic carrier concentrations between 2 and 5×10^{15} cm^{-3}. The Hall mobility for electrons and holes can be represented betwe 100° and 300°K by the expression $1.2 \times 10^{8} T^{-2}$ and $2.9 \times 10^{8} T^{-2.7}$ respectively. Both these results indicate a higher Hall mobility tha has been previously reported, and the result for holes is greater than values reported for the drift mobility. From the results between 350° and 500°K the expression $n_i = 3.10 \times 10^{16} T^{3/2} \exp(-0.603/kT)$ was obtained for the intrinsic concentration. Attemp were made to estimate the total impurity concentration in these specimens. The variation of extrinsic carrier concentration with temperature and the effect of impurity scattering at 20°K both indic that the total concentration of impurities is less than 10^{14} cm^{-3}. A

537.311.33 : 621.38

7959. ELECTRICAL CONTACTS TO SILICON CARBIDE. R.N.Hall.
J. appl. Phys., Vol. 29, No. 6, 914-17 (June, 1958).

Rectifying junctions may be made by heating silicon–aluminium or silicon-boron alloys in contact with n-type silicon carbide. The measured solubility of carbon in liquid silicon is consistent with the view that these junctions are produced by an alloying and regrowth mechanism. Non-rectifying contacts may be made in an analogous manner using silicon–phosphorous alloys. Visible radiation is emitted uniformly over the rectifying junctions when current is passed in the forward direction, with a quantum efficiency of the order of 10^{-6}. Current flow in the reverse direction is associated with the appearance of "blue spots", similar in appearance to the points of light that are often observed when silicon junctions are biased in the avalanche region.

537.311.33 : 535.34

7960. INFRARED SPECTRUM AND CARRIER MOBILITY IN THE INTRINSIC RANGE OF SILICON. F.R.Kessler and J.Schnell.
Z. Naturforsch., Vol. 13a, No. 6, 458-61 (June, 1958). In German.

The optical absorption K at wavelengths between 1 and 3.5 μ an the electrical conductivity σ were measured as a function of temper ature in the range from 300° to 1000°K for single crystals of silico The wavelength dependence of K corresponded with the Drude–Zene Frühlich theories for free-carrier absorption. From the two sets measurements the carrier concentration can be eliminated and the electron mobility determined as $\mu_e = 1.85 \times 10^{8} T^{-1.5}$ cm^2 V^{-1}sec^{-1}. By combining with the Hall effect measurements of other authors, the carrier concentration is given by

$$N_e = 5.71 \times 10^{15} T^{1.5} \exp(-1.16/2kT) \text{ cm}^{-3}$$

Carrier concentrations are used to check the band-edge data and the derived curve of ΔE v. T is joined smoothly to that given by Macfarlane and Roberts (see Abstr. 7848/1955) for the lower temperatures. C.A.Hogarth

537.311.33

7961. ON THE FIELD EFFECT IN INSULATING ZnO POWDER. W.Ruppel.
Z. Phys., Vol. 152, No. 2, 235-41 (1958). In German.

The photoconductive current in a ZnO powder sample is modified by a cross field, applied by means of a transparent blocking electrode. The magnitude of the field effect enables the recombination life-time to be calculated, and the rate of rise and decay of the effect make it possible to estimate the density of trapping centres. Results agree well with data from other sources. K.W.Plessner

537.311.33 : 537.323 : 538.22

7962. ELECTRICAL AND MAGNETIC PROPERTIES OF THE ZnSb–CdSb SYSTEM. I.M.Pilat, L.D.Chizh and S.Yu.Voltyshen.
Zh. tekh. Fiz., Vol. 28, No. 4, 786-8 (1958). In Russian.

Variation of electrical conductivity σ, activation energy ΔE, thermo-e.m.f. α, carrier mobility μ, Hall effect and magnetic susceptibility χ of the ZnSb–CdSb alloys was investigated in the composition range from 4 CdSb + ZnSb to CdSb + 4 ZnSb. All the investigated alloys displayed semiconducting properties. The character of the property v. composition curves indicates that CdSb and ZnSb form a series of solid solutions. Since all the studied properties reach their minimum (σ, χ) or maximum (ΔE, μ, α) values at the composition ZnSb + CdSb, the existence of an intermetallic compound $CdZnSb_2$ is postulated. M.H.Sloboda

537.311.33 : 621.376.22

7963. FREQUENCY CHARACTERISTIC OF A GERMANIUM INFRARED DIODE-MODULATOR. Yu.I.Ukhanov.
Zh. tekh. Fiz., Vol. 27, No. 9, 1950-3 (1957). In Russian.

The results are given of an investigation of the frequency characteristic of a germanium diode-modulator at 300°K. A germanium photodiode was used as receiver of the infrared rays from the diode-modulator. It was found that in the frequency range 20 c/s - 30 kc/s, the modulation effect does not depend upon frequency.

537.311.33 : 621.382

7964. EMISSION OF A SPHERICAL CONTACT IN A SWEEPING ELECTRIC FIELD. Z.S.Gribnikov and K.B.Tolpygo.
Zh. tekh. Fiz., Vol. 27, No. 10, 2232-9 (1957). In Russian.

The injection coefficient, which is the most important characteristic of emitters of semiconducting devices, is determined not only by the properties of the p–n junction or the contact metal–semiconductor, but also by the geometry of the contact, the current flowing across the contact and the sweeping field in which the contact is situated. The present paper deals theoretically and experimentally with the accurate calculation of the injection coefficient of a spherical contact in a sweeping field with a view to interpreting previous work.

537.311.33 : 539.164.08

7965. ON THE USE OF GERMANIUM N–P [JUNCTIONS IN] ALPHA-PARTICLE COUNTERS AT LOW TEMPERATURES. A.V.Airapetyants, A.V.Kogan, N.M.Reinov, S.M.Ryvkin and A.A.Sokolov.
Zh. tekh. Fiz., Vol. 27, No. 7, 1599-600 (1957). In Russian.

The low working voltages needed for the counter, its small size, and its simplicity make it useful in cryostats at liquid-helium temperatures to study oriented nuclei. Whereas the signal/noise ratio in counting the α-particles from Po is ~ 10 at 300°K, it is ~ 100 at 1.5°K, although the pulse height remains approximately constant at 2 mV. A diagram is given of a typical cryostat application, and a photograph of the pulse shapes as observed, after amplification, on an oscilloscope. Metallurgical Abstracts

537.311.33

7966. THE CURRENT–VOLTAGE CHARACTERISTIC OF A METAL–ALUMINIUM ANTIMONIDE POINT CONTACT. Yu.V.Ilisavskiĭ.
Zh. tekh. Fiz., Vol. 28, No. 5, 965-73 (1958). In Russian.

The method of preparing the AlSb used is described. The product had grains of diameter ~ 3 mm and was not decomposed by several months exposure to the atmosphere; if undoped it was p-type (0.01-5 ohm cm). Specimens of n-type AlSb (up to 300 ohm cm) were obtained by doping with Te, Se, or Sb_2Se_3. The smallest carrier concentration obtained was 10^{17} per cm^3. Electrolytically polished points (radius ~ 10 μ) of phosphor bronze, beryllium bronze, or tungsten were used to study ground, polished, or cleaved AlSb surfaces. Reverse breakdown voltages up to 80 V were observed with "unformed" points. "Forming" (by passing large forward currents) improved the observed rectification ratios (typically 30 and 700 at 1 V before and after forming). The barrier height as determined by extrapolating the linear portion of the forward characteristic was 0.38 V; the temperature dependence of the reverse saturation current gave barrier heights of ~ 0.33 V for p- and n-type material. This is anomalous (the forbidden gap is ~ 1.6 eV), and the expected advantages of point-contact AlSb diodes for high temperature operation are thus not obtained. Experiments on strong field effects were made, the necessary non-rectifying point contacts being made by applying impulsive voltages larger than breakdown; after the ohmic region ($I \propto V$), there was a region with $I \propto V^{3/2}$; by using pulsed voltages it was shown that this non-ohmic behaviour was not a thermal effect — it was thought to be due to impurity ionization; the breakdown field was estimated to be 4.10^4 V/cm. K.F.Hulme

537.311.5

7967. CORRELATIVE RELATIONS FOR RANDOM ELECTRIC CURRENTS AND FIELDS AT LOW TEMPERATURES. F.G.Bass and M.I.Kaganov.
Zh. éksper. teor. Fiz., Vol. 34, No. 5, 1154-7 (1958). In Russian.

Correlative functions between the components of a random electric field were obtained taking into account spatial dispersion. The correlation radius depends on the frequency. At $\delta(\omega) \gg l$ (where δ is the depth of penetration of a low-frequency field and l is the electron mean free path) it is identical with the depth of the skin-effect layer, whereas at $\delta(\omega) \ll l$ it coincides with the mean free path. A.

537.311.62 : 539.2

7968. CONCERNING THE ANOMALOUS SKIN EFFECT IN THE INFRARED REGION. L.P.Pitaevskiĭ.
Zh. éksper. teor. Fiz., Vol. 34, No. 4, 942-6 (1958). In Russian.

The surface impedance of metals at low temperatures is computed for the infrared region taking into account collisions between electrons. The electrons are considered as a Fermi liquid with an arbitrary dispersion law for the quasiparticles. A.

537.311.62

7969. QUANTUM THEORY OF HIGH-FREQUENCY CONDUCTIVITY OF METALS. M.Ya.Azbel'.
Zh. éksper. teor. Fiz., Vol. 34, No. 4, 969-83 (1958). In Russian.

A quantum theory of electric conductivity is developed for metals located in a high-frequency electromagnetic and constant magnetic fields. The conduction electron dispersion law and the nature of reflection from the surface are assumed to be arbitrary. It is shown that in the high-frequency case the amplitude of the quantum oscillations is generally larger than in the static case. The quantum oscillations described here have not yet been observed. A.

537.311.62

7970. QUANTUM OSCILLATIONS OF HIGH-FREQUENCY SURFACE IMPEDANCE. M.Ya.Azbel'.
Zh. éksper. teor. Fiz., Vol. 34, No. 5, 1158-68 (1958). In Russian.

A quantum formula for the total surface impedance of metals was obtained for high frequencies on basis of the general formulae previously obtained by the author (see preceding abstract). The depth of the skin layer is assumed to be small compared with the Larmor radius and mean free path of the electrons. The analysis is carried out for an arbitrary dispersion law of the conduction electrons. Cases involving constant magnetic fields parallel to the metal surface or inclined to the latter are investigated. The influence of the thickness of the metallic film on the quantum oscillations is ascertained. It is shown that in principle a study of the surface impedance in a strong magnetic field should permit one to reconstruct the shape of the Fermi surface and determine the velocities of the electrons on it. A.

537.312.5 : 621.315.59

7971. MAXIMUM PERFORMANCE OF HIGH-RESISTIVITY PHOTOCONDUCTORS. R.W.Redington.
J. appl. Phys., Vol. 29, No. 2, 189-93 (Feb., 1958).

It is shown that the transit time in a photoconductor cannot be less than the charge relaxation or storage time if the photoconductor has contacts of the "space charge", or ohmic, type. The principal consequence of the observation is that the photoconductor cannot simultaneously act as a detector, an amplifier, and a storage element and still have a response time as short as the storage time. This puts a restriction on the performance of high-resistivity photoconductive devices. For example, with present television standards and acceptable response times, the maximum quantum efficiency

possible for a photoconductive camera tube of the vidicon type, with space-charge limited dark current, is less than unity. A.

537.312.5 : 535.343

7972. OPTICAL TRANSMISSION AND PHOTOCONDUCTIVE AND PHOTOVOLTAIC EFFECTS IN ACTIVATED AND UNACTIVATED SINGLE CRYSTALS OF ZnS. G.Cheroff and S.P.Keller.
Phys. Rev., Vol. 111, No. 1, 98-102 (July 1, 1958).

Certain physical properties of single crystals of ZnS and of ZnS activated with Mn, Cu, and Al were determined. The optical studies involve transmission spectra. Photovoltages much larger than the energy gap were measured. Reversals in the sign of the voltage were measured as a function of the wavelength of incident light. The photovoltages and photocurrents were determined as functions of wavelength and of intensity of incident light. A description is presented in which the characteristics of the crystals are treated as simple circuit elements. A.

537.312.5 : 537.311.33

7973. THE EFFECT OF ADSORPTION OF MOLECULES AND OF AN EXTERNAL FIELD ON THE PHOTOCONDUCTIVITY OF SEMICONDUCTORS. V.I.Lyashenko and O.V.Snitko.
Radiotekhnika i Elektronika, Vol. 2, No. 3, 269-77 (1957).
In Russian.

The kinetics of the photoconductivity of thin (50-200 μ) specimens of Cu_2O and of natural MoS_2 was studied by a previously developed technique (see Lyashenko and Snitko, Trudy Instituta Fiziki Akad. Nauk Ukrain. SSR, Vol. 5, 65, 77, 1954). The effects of surface adsorption and external field are described and interpreted.

C.H.L.Goodman

537.312.5

7974. PHOTOCONDUCTIVITY-QUENCHING AND LIFETIME OF CONDUCTION ELECTRONS. F.Matossi.
Z. Phys., Vol. 151, No. 1, 5-9 (1958). In German.

Stimulation and quenching effects in photoconductors are analysed so that the electron lifetime may be determined from simple experimental results. C.A.Hogarth

537.312.5

7975. ON THE SPECTRAL DISTRIBUTION OF THE PHOTOCONDUCTIVITY IN CdS SINGLE CRYSTALS.
K.W.Böer and H.Gutjahr.
Z. Phys, Vol. 152, No. 2, 203-13 (1958). In German.

The spectral distribution of photoconductivity was determined in the region of the absorption edge of CdS crystals at room temperature and -180°C at various applied potentials. The structure of the distribution curves depended on the individual crystals and showed variations in different parts of the same crystal. Changes in distribution induced by irradiation with X-rays, disappeared after the crystal was held at room temperature for 48 hr. J.Franks

537.312.5 : 537.311.33

THE SURFACE POTENTIAL OF SELENIUM AND ITS RELATION TO PHOTOVOLTAIC EFFECTS. See Abstr. 7949

537.312.5 : 537.311.33

EFFECT OF IODINE ON THE PHOTOELECTRIC PROPERTIES OF SELENIUM. See Abstr. 7951

537.312.5 : 621.382

7976. SILICON PHOTODIODES.
S.M.Ryvkin, N.B.Strokan, V.M.Tuchkevich and V.E.Chelnokov.
Zh. tekh. Fiz., Vol. 28, No. 6, 1165-8 (1957). In Russian.

The diodes (~ 7 mm^2 area) were made by the diffusion of Sb into p-type Si (1 ohm cm). Data are presented on their sensitivity (~ 6 mA/lm), its spectral distribution (peaking ~ 0.8 μ) and temperature dependence (-80° to $+60^\circ$C), the voltage–current characteristics (dark and illuminated), and the rise and decay of photocurrent under pulsed illumination (2×10^{-6} sec rise time of light pulses). Under weak illumination the decay time was often governed by the discharge of the barrier capacitance through the load resistance, but under strong illumination it should become dependent on the carrier lifetime; this consideration enabled an upper limit of 10^{-6} sec to be placed on the lifetime. K.F.Hulme

537.312.5 : 621.382

7977. THE KINETICS OF PHOTO-TRIODES.
S.M.Ryvkin and N.B.Strokan.
Zh. tekh. Fiz., Vol. 28, No. 6, 1169-73 (1958). In Russian.

The decay time of the photocurrent in Ge photo-transistors (4 mm^2 area, dark current 600 μA, sensitivity 1-4 A/lm) was studied using pulsed illumination (2×10^{-6} sec rise-time of light pulses); typical decay times were 2×10^{-5} sec. It is argued that the collector current should decay more rapidly than the emitter-base voltage; the method used to verify this is described.

K.F.Hulme

537.312.5

7978. THE TEMPERATURE DEPENDENCE OF THE PHOTOEFFECT OF Sb–Cs PHOTOCATHODES IN THE TEMPERATURE RANGE FROM -170° TO $+20^\circ$C. Z.Náray.
Ann. Phys. (Leipzig), Vol. 20, No. 7-8, 386-9 (1957). In German.

Near the threshold wavelength the sensitivity decreases monotonically with decreasing temperature. At shorter wavelengths the sensitivity is independent of temperature over a wide temperature range, but decreases rapidly at very low temperatures.

J.Franks

537.312.5

7979. INTERFERENCE PHOTOCATHODES WITH INCREASED OUTPUT AND A FREELY SELECTED SPECTRAL MAXIMUM.
K.Deutscher.
Z. Phys., Vol. 151, No. 5, 536-55 (1958). In German.

The cathode consisted of a semi-transparent photosensitive layer (Al for u.v., $SbCs_3$ for visible light), on a MgF_2 dielectric layer, evaporated on to a Al mirror. For a selected wavelength, the reflectivity of the photocathode is very small and the photosensitive layer absorbs most of the incident radiation close to the emitting surface. Electron emission may exceed that of a conventional photocell by an order of magnitude. J.Franks

537.312.62

7980. SPIN EXCHANGE IN SUPERCONDUCTORS.
B.T.Matthias, H.Suhl and E.Corenzwit.
Phys. Rev. Letters, Vol. 1, No. 3, 92-4 (Aug. 1, 1958).

The transition temperature T_c of La is depressed by alloying with rare-earth metals. The size of the effect appears to be correlated with the spin-moment of the dissolved ion, rather than the total moment, and is greatest for Gd. T_c falls linearly with Gd concentration to 0°K at 1.1% Gd; above 3% Gd the alloys are ferromagnetic at low temperatures. From this and other evidence it is suggested that electronic configurations favouring superconductivity also favour ferromagnetism. R.G.Chambers

537.312.62 : 538.54

7981. MAGNETIC FIELD DEPENDENCE OF HIGH-FREQUENCY PENETRATION INTO A SUPERCONDUCTOR. M.Spiewak.
Phys. Rev. Letters, Vol. 1, No. 4, 136-8 (Aug. 15, 1958).

The penetration depth λ in Sn and In was investigated, by measurements of surface reactance X at 1000 Mc/s, in longitudinal and transverse fields H. It is found that λ(H) depends in a complex way on temperature, crystal orientation and field orientation; in particular it is found that λ often decreases as H increases.

R.G.Chambers

537.312.62

7982. ON THE ENERGY SPECTRUM OF SUPERCONDUCTORS.
L.P.Gor'kov.
Zh. éksper. teor. Fiz., Vol. 34, No. 3, 735-9 (1958). In Russian.

A method is proposed, based on the mathematical apparatus of the quantum field theory, for the calculation of the properties of a Fermi gas with attractive interaction of the particles. A

537.312.62

7983. SURFACE RESISTANCE OF SUPERCONDUCTING CADMIUM. M.S.Khaikin.
Zh. éksper. teor. Fiz., Vol. 34, No. 6, 1389-97 (1958). In Russian.

An apparatus is described which can be used to measure the surface resistance of a metal at a wavelength of 3.2 cm in the "super-low" temperature region of ~ 0.1°K. The total surface resistance of a cadmium single crystal was measured in the temperature interval between 0.1 and 0.6°K. The results of the measurements were analysed and the penetration depth of the electromagnetic field in superconducting cadmium was determined, and for $T \to 0$ found to be $\delta_0 = (13 \pm 1.4) \times 10^{-6}$ cm. A

537.312.62 : 538.22

7984. ELECTRIC AND MAGNETIC BEHAVIOUR OF Nb_3Sn IN THE SUPERCONDUCTING TRANSITION REGION. W.Wiedemann.
Z. Phys., Vol. 151, No. 3, 307-27 (1958). In German.

Rods of Nb_3Sn were prepared by sintering the components at 1250°C, pulverizing and compressing to 17 000 atm. The resistance transition occurred at $18.07 \pm 0.05^\circ$K and the magnetic transition at $18.02 \pm 0.05^\circ$K; both were about 0.04 deg K wide. On passing a steady current through the rod, the magnetic transition showed a "paramagnetic effect" similar to that found in pure superconductors but very much smaller. This is attributed to the porosity of the material; its density was about 80-85% of the X-ray density.

R.G.Chambers

537.312.62

7985. ON THE THEORY OF SUPERCONDUCTIVITY. H.Koppe and B.Mühlschlegel.
Z. Phys., Vol. 151, No. 5, 613-29 (1958). In German.

The expression for the eigenfunction used by Bardeen, Cooper and Schrieffer (Abstr. 1708/1958) is derived from canonical transformations. After a short discussion of possible generalizations, formulae are derived for general transformations with pairs of operators. The application of this formalism to the B.C.S. theory does not give any new results but leads to a considerable simplification of the representation. H.London

537.312.62

7986. THE SUPERCONDUCTING PARABOLIC CYLINDER IN A LONGITUDINAL MAGNETIC FIELD. G.U.Schubert.
Z. Phys., Vol. 152, No. 1, 59-74 (1958). In German.

The London equations are solved for a superconductor having a convex or concave boundary of this shape. R.G.Chambers

537.312.62 : 538.566.2

PROPAGATION OF ELECTROMAGNETIC WAVES IN SUPERCONDUCTORS. See Abstr. 7214

537.312.62 : 534.321.9 : 539.2

ULTRASONICS IN THE STUDY OF SUPERCONDUCTORS. See Abstr. 7477

537.312.8

7987. MAGNETORESISTANCE OF SINGLE CRYSTALS OF COPPER. R.Olson and S.Rodriguez.
Phys. Rev., Vol. 108, No. 5, 1212-18 (Dec. 1, 1957).

Measurements of the magnetoresistance coefficients at 4.2°K and at 20.4°K in single crystals of copper, silver, and gold in the low magnetic field range, and in single crystals of silver for high magnetic field are reported. The low-field results were analysed under the assumptions that a relaxation time exists and is a function of the energy alone, and that the Fermi surface is a single closed surface within the first Brillouin zone and not touching its boundary. It is found that for copper the magnetoresistance cannot be fitted very well on this model. It is assumed that at low temperature the hypothesis that a relaxation time exists is a good approximation, and suggest that in copper the Fermi surface touches the boundary of the first Brillouin zone. The magnetoresistance of silver in high magnetic fields shows marked anisotropy and no sign of saturation. A.

537.312.8

7988. MAGNETORESISTANCE COEFFICIENTS AND THEIR TEMPERATURE DEPENDENCE IN IRON AND SILICON-STEEL. E.Tatsumoto.
Phys. Rev., Vol. 109, No. 3, 658-62 (Feb. 1, 1958).

By using single-crystal strips of iron and silicon steel having the crystallographic orientations (001) - [100] and (1$\bar{1}$0) - [111], the magnetoresistance coefficients ρ_1,ρ_2, and their temperature dependence were measured below room temperature. The measurement of ρ_1 was accomplished by changing the domain structure in the demagnetized state by utilizing the magnetic field induced by the measuring current in the sample. It is found that both ρ_1 and ρ_2 are strongly dependent on temperature and composition, but it seems difficult to obtain a complete quantitative interpretation of the results. A.

537.312.9 : 537.312.6

7989. THE INFLUENCE OF ISOTROPIC PRESSURE ON THE ELECTRIC CONDUCTIVITY OF METALS AT LOW TEMPERATURES. L.S.Kan and B.G Lazarev.
Zh. éksper. teor. Fiz., Vol. 34, No. 1, 258-9 (1958). In Russian.

The authors give a report of their measurements of the electric resistivity of metals at pressures up to 1730 atm and at temperatures of liquid nitrogen, hydrogen and helium. The metals under investigation were single crystals of zinc, lead and bismuth and polycrystalline gold. Results are reviewed without much detail being given. In particular, it has been found that at the lowest temperatures resistivity of all metals increases with increasing pressure. At higher temperatures this effect tends to diminish. It persists with bismuth at all temperatures but changes sign with the other metals; the change of sign occurs below 10°K with lead and about 20°K with gold and zinc. Without attempting to present a theory of their results the authors remark that the electrons in compressed metals appear to behave like the electrons in semiconductors, the energy gap being small. R.Eisenschitz

537.321 : 538.27 : 537.311.3

THERMOELECTRIC EFFECTS IN ISOTROPIC METALS AND SEMICONDUCTORS. See Abstr. 7897

537.323 : 621.318.12

7990. THERMOELECTRIC PROPERTIES OF FERRITES NEAR CURIE TEMPERATURE. S.A.Vachenya and Ya.G.Dorfman.
Radiotekhnika i Elektronika, Vol. 2, No. 3, 345-7 (1957). In Russian.

Describes the method and results of an experimental investigation of the dependence of thermo-e.m.f. near the Curie point for nickel-zinc ferrites. Anomalies in Peltier and Thomson effects were found. It is shown that in some semiconductors carrier electrons take part in ferromagnetism. W.Bezdel

537.323

7991. THE EFFECT OF DEGENERATION ON THE EFFICIENCY OF SEMICONDUCTOR THERMOELECTRIC CELLS. T.S.Stavitskaya and L.S.Stil'bans.
Zh. tekh. Fiz., Vol. 28, No. 3, 484-8 (1958). In Russian.

The variation of the coefficient of thermo-e.m.f. α, conductivity σ and $\alpha^2\sigma$ with the carrier concentration (n) was studied theoretically for both degenerate and non-degenerate electron gases. Three cases were considered corresponding to scattering of the carriers on (1) thermal vibrations of the lattice; (2) ionic lattice; and (3) impurity ions. In the first case degeneration has only a slight effect on the optimum conditions for $\alpha^2\sigma$. In the second case, however, there is no longer a maximum on the $\alpha^2\sigma/n$ curve, with $\alpha^2\sigma$ approaching asymptotically a constant value, while in the third case $\alpha^2\sigma/n$ increases indefinitely with increasing n. The theoretical conclusions for the first case were confirmed by the results of experiments carried out on specimens of PbTe (with n ranging from 5×10^{17} to 2×10^{20} cm^{-3}) for which α/n, σ/n, $\alpha^2\sigma/n$, σ/T, and $\alpha^2\sigma/T$ were determined. M.H.Sloboda

537.323

7992. THE THERMOELECTRIC PROPERTIES OF SOME COMPOUNDS AND ALLOYS WITH A HIGHLY DEGENERATE ELECTRON GAS. N.V.Kolomoets.
Zh. tekh. Fiz., Vol. 28, No. 5, 936-9 (1958). In Russian.

The theory of the thermoelectric power of metals and alloys is used in an attempt to help the search for materials suitable for thermoelectric devices — the borides, nitrides, and carbides of the transition metals, which have been extensively studied, are considered to be metallic. It is concluded that for maximum efficiency the energy derivative at the Fermi level of the density of states function must be maximized. K.F.Hulme

537.323

7993. THE THERMOELECTRIC PROPERTIES OF BISMUTH TELLURIDE WITH ALLOYING ADMIXTURES. G.I.Gordyakova and S.S.Sinani.
Zh. tekh. Fiz., Vol. 28, No. 5, 977-80 (1958). In Russian.

The room-temperature values of the number of carriers per cm^3 (from Hall-constant measurements), the electrical conductivity σ, the carrier mobility, the thermoelectric power α, and the product $\alpha^2\sigma$, were determined for specimens of Bi_2Te_3 doped with I, CuBr, or Pb (some measurements were also made on Cu-doped Bi_2Te_3); the results are given plotted against the number of doping atoms or molecules per cm^3. Pb-doped specimens were p-type and the maximum value of $\alpha^2\sigma$ obtained was 32×10^{-6} V^2/deg C ohm cm. The other dopes made Bi_2Te_3 n-type with maximum values of $\alpha^2\sigma$ of $\sim 25 \times 10^{-6}$ V^2/deg C ohm cm. The variations of α, σ and $\alpha^2\sigma$ with temperature (0-330°C) were also measured; in some cases the value of $\alpha^2\sigma$ at 330°C was as high as the value at 0°C (this is significant in connection with thermoelectric devices, since $\alpha^2\sigma$ appears in the figure of merit of a material for this application). K.F.Hulme

537.323 : 537.311.31

THERMOELECTRIC POWER OF FIVE Sn—Sb ALLOYS. See Abstr. 7904

537.323 : 537.311.33

THERMOELECTRIC PROPERTIES OF ALUMINIUM ANTIMONIDE. See Abstr. 7934

537.323 : 538.22 : 537.311.33

THERMO-E.M.F. OF ZnSb—CdSb. See Abstr. 7962

537.324

7994. IMPULSE-OPERATION OF COOLING THERMOELECTRIC CELLS. L.S.Stil'bans and N.A.Fedorovich.
Zh. tekh. Fiz., Vol. 28, No. 3, 489-92 (1958). In Russian.

A general expression for the temperature of the cold junctions of a thermoelement is derived. It is shown analytically and experimentally that the inertia of a thermoelement is proportional to the square of its linear dimensions, and that the rate of cooling is proportional to the magnitude of the current. When a pulsating current of an amplitude greater than the optimum current under steady conditions is employed, the inertia is greatly reduced and short-time cooling-effects, considerably larger than the maximum

obtainable under steady conditions, can be secured.

M.H.Sloboda

537.363 : 532.712

ELECTROPHORETIC ELECTROOSMOTIC PRESSURE.
See Abstr. 7744

ELECTRIC DISCHARGES

537.521

7995. LATERAL-CURRENT CONTROL MECHANISM FOR COLD-CATHODE GAS DISCHARGES. D.J.Belknap and L.R.Crump.
J. appl. Phys., Vol. 29, No. 4, 737-8 (April, 1958).

The discharge current of cold-cathode gas-filled tubes can be controlled by drawing a small lateral current from the gas discharge by means of either an internal or external control-electrode. This electrode is able to control the magnitude of the main discharge current within both the Townsend and glow regions and to switch the discharge from either region to the other. This process has many applications. A.E.D.Heylen

537.523.2

7996. EMISSION MECHANISM OF COLD-CATHODE ARCS. K.G.Hernqvist.
Phys. Rev., Vol. 109, No. 3, 636-46 (Feb. 1, 1958).

A new theory for the electron-emission mechanism of cold-cathode arcs is proposed in which excited atoms play a predominant role as a source for ion generation in the vicinity of the cathode surface. The processes of resonance ionization of excited atoms at the cathode surface and of ionization of excited atoms in the strong electric field at the cathode surface are considered. Special emphasis is given to the dispersed (or D-type) arc, which operates with a relatively low emission-current density. An analysis of the D-type of arc is given based on the proposed theory. Recent studies of this arc are shown to corroborate the theory. The rapid decrease of electron plasma temperature and population of excited atoms during arc-current interruption offer an explanation for the short extinguishing time of cold-cathode arcs. A.

537.523.4

7997. THE ELECTRICAL BREAKDOWN OF GASES IN THE PRESENCE OF CROSSED ELECTRIC AND MAGNETIC FIELDS. H.A.Blevin and S.C.Haydon.
Z. Phys., Vol. 151, No. 3, 340-4 (1958).

The breakdown characteristics of a gas in the presence of crossed electric and magnetic fields are discussed in terms of the Townsend ionization coefficients. The "equivalent pressure" concept is used to assess the effect of a transverse magnetic field on the first Townsend coefficient and the objections which have been raised to the application of this approach to breakdown potentials are shown to be removed by a consideration of the dependence of the second Townsend coefficient upon electric and magnetic field strengths. A.

537.523.4

7998. EXPERIMENTAL STUDIES ON THE INITIATION OF ELECTRIC ARCS. T.Yamaguti.
J. Phys. Soc. Japan, Vol. 13, No. 5, 520-6 (May, 1958).

It is pointed out that customary theories concerning the initiation of stable arcs under atmospheric pressure present some difficulties. Considering that the boiling point of the electrode and the work function of the cathode may take part in the initiation, arcs between electrodes with remarkably different boiling points were experimentally investigated. The results are qualitatively explained by two stability conditions: (a) an arc spot of one of the electrodes at least must be in boiling state, and (b) the ionization potential of the evaporated metal vapour must be larger than double the work function of the cathode material. A.

537.523.5

7999. THE APPEARANCE OF VAPOUR BEAMS IN CARBON ARCS AT HIGH CURRENT STRENGTHS. I. R.Wienecke.
Z. Phys., Vol. 150, No. 2, 231-41 (1958). In German.

Describes the beams of incandescent vapour emitted from the cathode in carbon arcs, in atmospheric air, carrying currents varying from 100 to 1400 A. The effect of a transverse magnetic field is described. J.D.Craggs

537.523.5

8000. ON THE PRODUCTION OF VAPOUR BEAMS IN CARBON ARCS AT HIGH CURRENT STRENGTHS. II. R.Wienecke.
Z. Phys., Vol. 151, No. 2, 159-73 (1958). In German.

For Pt I see preceding abstract. Description of experiments with carbon arcs carrying currents 500-1400 A, with special reference to a study of vapour jets. Jet velocities were measured by optical techniques, which are described. The phenomena are briefly discussed, for example, with reference to Maecker's recent work. J.D.Craggs

537.523.74 : 621.387

8001. THE EFFECT OF DIFFUSION ON THE ONSET OF THE HIGH FREQUENCY IMPULSE DISCHARGE IN ARGON. T.S.Abramova and V.E.Golant.
Zh. tekh. Fiz., Vol. 28, No. 5, 1096-101 (1958). In Russian.

The dependence of field strength at which discharges set in on dimensions of the discharging volume at different gas pressures was studied using 1.1 μsec pulses of the 9400 Mc/s field with the pulse repetition frequency of 500 c/s. An analysis of these results shows under what conditions the effect of diffusion of electrons on the onset of discharges has to be taken into account. Z.Krasucki

537.525 : 533.73

8002. METHOD OF DETERMINATION OF MEAN KINETIC ENERGY OF ELECTRONS IN DRUYVESTEYN–DAVÝDOV DISTRIBUTION. G.Rotman.
Dokl. Akad. Nauk SSSR, Vol. 120, No. 5, 999-1002 (1958). In Russian.

The Druyvesteyn–Davýdov distribution applies to electrons in low-pressure discharges; the mean electron energy is determined from a representation of the distribution parameters in terms of current, field gradient and pressure. J.W.Gardner

537.525

8003. RESEARCHES ON THE DOUBLE CATHODE EFFECT. E.Badareu and I.Popescu.
J. Electronics and Control, Vol. 4, No. 6, 503-14 (June, 1958).

Experiments were performed with double (plane-parallel) cathodes in dry air at about 0.5 mm Hg pressure with various anode configurations. Probe and microphotometric measurements were made. It was concluded that the effect is closely associated with the uniform luminous plasma region between the cathodes, and that some of the secondary emission from the cathodes is caused by 10-20 eV photons from this plasma. D.Walsh

537.52

8004. POSITIVE COLUMN OF DISCHARGE IN THE Ne–Hg MIXTURE AT A SMALL DISCHARGE CURRENT. H.Rothman.
Stud. Cercetări Fiz., Vol. 9, No. 1, 53-73 (1958). In Roumanian.

Presents in graphical form the semi-log characteristics of probes in the discharge column investigated, both when irradiated and not irradiated with a Hg-vapour lamp. The differences between the curves of the mean kinetic energy of electrons, derived from the straight parts of these graphs, and the theoretical curves of electron temperatures (from Schottky's theory) cannot be explained by the cataphoretic effect. The author suggests that the velocity distribution in the mixture under investigation is a transitional non-Maxwellian form. F.Lachma

537.525 : 535.33

8005. SPECTROSCOPIC INVESTIGATION OF A POWERFUL PULSED DISCHARGE IN HYDROGEN. II. S.Yu.Luk'yanov and V.I.Sinitsyn.
Zh. éksper. teor. Fiz., Vol. 34, No. 4, 849-55 (1958). In Russian.

For Pt I see Atomnaya energiya, Vol. 1, 88, (1956). Mirror scanning was used to investigate the spectral properties of the radiation from the hydrogen plasma in a low-pressure gas discharge involving currents up to 500 kA. The temporal behaviour of the discharge spectrum in the visible region can be studied by the method mentioned above. During compression of the plasma striation a flash in the continuous spectrum is observed. Results obtained by adding nitrogen and helium indicate a high electron temperature in the plasma at these moments. An estimate of the concentration of the charged particles is made on basis of broadening of the H_α line

537.525 : 538.

8006. THE POSITIVE LOW-PRESSURE COLUMN IN A HOMOGENEOUS MAGNETIC CROSS FIELD. M.Danders.
Z. angew. Phys., Vol. 9, No. 5, 223-33 (May, 1957). In German.

The theory of the cylindrical positive low-pressure column in weak homogeneous magnetic cross field is treated in a Schottky manner as an extension to the diffusion theory of the undistorted positive column. The equation for the charge carrier density distribution under the influence of the magnetic field across the positive column is deduced and relations are given for the location and height of the carrier density maximum and for the electron temperature and longitudinal gradient as a function of the cross field strength.

he experimental method to test the validity of the theory is des-ribed and good agreement is reached. In conclusion the current ependence on the magnetic field is examined. Agreement with theory the region of high charge carrier density is found only when a re-uction of electron velocity is postulated of an order of magnitude hich can be calculated using equations given by Gvosdover hysikalische Zeitschrift der Sowjetunion, Vol. 12, No. 2, 164-81, 937). This reduction of electron velocity is also observed by easurement and by reason of a reduced influence of the own mag-etic field on the density distribution. A.E.D.Heylen

537.525

007. THE EFFECT OF THE ELECTRON CURRENT COMPONENT N DEVELOPMENT OF ELECTRICAL BREAKDOWN IN HIGH ACUUM. L.I.Pivovar, V.M.Tubaev and V.I.Gordienko.
h. tekh. Fiz., Vol. 27, No. 5, 997-1000 (1957). In Russian.

The influence of a magnetic field on breakdown voltage and pre-scharge current was investigated in vacuum $1\text{-}3 \times 10^{-6}$ mm Hg sing electrodes of various materials (Cu, Pb, Al) with spacings up 5 mm. It was found that the breakdown voltage was not affected the magnetic field for gap spacings up to 2 mm; between 3 and 5 mm breakdown occurred at voltages 20-25% higher than the corres-onding breakdown voltages when no magnetic field is present. At oltages close to the breakdown voltage the predischarge current onsists mainly of the electron current, the latter being dependent the material of the anode. E.M.Dembinski

537.525 : 621.3.015.5

008. THE MECHANISM OF ELECTRIC BREAKDOWN IN ACUUM. I.N.Slivkov.
h. tekh. Fiz., Vol. 27, No. 9, 2081-8 (1957). In Russian.

To clarify the mechanism of electric breakdown in vacuum etween not too excessively curved electrodes at voltages of some 0 kV the relationship between breakdown voltage and field strength ear the electrodes was determined experimentally and the decisive fluence of the electrode material on breakdown voltage ascertained. tentative interpretation of the breakdown mechanism based on xperimental findings is presented.

Electrical Research Association

537.525.3 : 621.387

009. THE TOWNSEND DISCHARGE IN A COAXIAL DIODE TH AXIAL MAGNETIC FIELD. P.A.Redhead.
anad. J. Phys., Vol. 36, No. 3, 255-70 (March, 1958).

An approximate theory is developed of the breakdown character-tics of a coaxial diode in an axial magnetic field, taking into count the effects of elastic collisions. It is assumed that the elec-on moves in a constant electric field between collisions and thus e theory is valid only in the appropriate range of magnetic field d voltage. Estimates of transit time and of space-charge effects e also made. Measurements in the pressure range from 10^{-3} to $^{-9}$ mm Hg are in general agreement with the theory. A.

537.525.5

010. ELECTRON MULTIPLICATION PROCESSES IN HIGH-OLTAGE ELECTRICAL DISCHARGE IN VACUUM. A.I.Bennett.
appl. Phys., Vol. 28, No. 11, 1251-3 (Nov., 1957).

The efficiency of a class of electron-multiplication processes eviously considered to be possible initiators of high-voltage cuum arcs was studied as a function of applied voltage in the ltage range below about 150 kV. This efficiency is found to be pically less than one part in ten thousand, in contrast to the unity greater required for arc initiation by such processes. The vari-ion of the efficiency with field is noted. The conclusion is drawn at this class of processes apparently plays no significant role in c initiation, and the remaining possibilities are briefly discussed. A.

537.525.5

011. THE HOLLOW CATHODE DISCHARGE IN MERCURY APOUR. E.Badareu and F.Wächter.
Electronics and Control, Vol. 4, No. 6, 539-43 (June, 1958).

The discharge tube consisted of a pair of circular cathode disks th annular anodes that were symmetrical when the cathode separa-on was varied. Mercury vapour pressures of up to 2 mm Hg were ed. The amplification factor (ratio of the double cathode current the current to both cathodes taken singly) was measured. This s found to vary rapidly with pressure and to attain a value as high 500 at low pressures. D.Walsh

537.525.5

012. VACUUM ARCS ON TUNGSTEN CATHODES. H.Wroe.
ture (London), Vol. 182, 338-9 (Aug. 2, 1958).

Briefly describes the appearance of cathode spot craters, etc., on the electrodes of 150 A arcs (pressure 10^{-3} mm Hg). Photographs show the localization of cathode spots along cracks, where these exist. The craters are $\sim 10^{-3}$ mm in radius; current densities at them may be 10^{7}-10^{8} A/cm^2. J.D.Craggs

537.525.5

8013. THEORY OF "RETROGRADE MOTION".
G.Ecker and K.C.Müller.
Z. Phys., Vol. 151, No. 5, 577-94 (1958). In German.

A careful theoretical study is given of the phenomenon of "retrograde motion" occuring in an arc-discharge subjected to a transverse magnetic field. The numerical results obtained from the model are in fair agreement with experiment. P.Roman

537.525.8

8014. THE POTENTIAL AND FIELD STRENGTH VARIATIONS IN THE CATHODE-FALL REGION OF GLOW DISCHARGES.
G.Brederlow.
Ann. Phys. (Leipzig), Folge 7, Vol. 1, No. 6-8, 359-76 (1958). In German.

Describes the hot-wire probe method for investigating the cathode-fall region of low pressure glows. Circuits are described and probe characteristics are given. Data are presented for He, Ne, A, H_2 and N_2 (pressure 0.1 – 1 mm Hg) in considerable detail. J.D.Craggs

537.525.8

8015. THE MEASUREMENT OF THE INTERNAL ELECTRICAL CHARACTERISTICS OF HIGH FREQUENCY RING DISCHARGES.
G.Birkhoff.
Z. angew. Phys., Vol. 10, No. 5, 204-6 (May, 1958). In German.

Using a probing coil, certain characteristics of electrodeless h.f. ring discharges were measured. Discharge frequencies varied from 22.5 to 61.5 Mc/s. Current densities, magnetic field strengths and voltage variations were measured. J.D.Craggs

537.525.82

8016. FORMATION OF THE PLASMA STRUCTURE DURING THE DEVELOPMENT OF A DISCHARGE. A.A.Zaĭtsev and V.E.Mitsuk.
Dokl. Akad. Nauk SSSR, Vol. 119, No. 3, 469-70 (1958). In Russian.

The collapse of the positive column into a series of luminous striations is studied by taking superposed photographs displaying the discharge in various conditions; examples are shown. A favourable comparison is made of the data with the theory of the Thomsons'. S.F.Edwards

537.529 : 536.422.1

8017. WINDOW METHOD OF OBSERVATION INSIDE A METAL VAPOUR, WHICH EXISTS FOR A SHORT PERIOD. EXAMPLE: WIRE EXPLOSION. W.M.Conn.
Naturwissenschaften, Vol. 45, No. 1, 6-7 (1958). In German.

See Abstr. 4591 (1955), 2145 (1956). Describes a method of mounting a thin Mylar sheet in the vicinity of the wire, which enables observations to be made for about 10 μsec. J.M.Hough

X-RAYS

537.531 : 535.333 : 535.343

8018. THE $L_{2,3}$ EMISSION SPECTRUM AND THE POSITION OF THE $L_{2,3}$ ABSORPTION LIMIT OF S IN CdS. G.Eichhoff.
Ann. Phys. (Leipzig), Folge 7, Vol. 1, No. 1-3, 55-69 (1958). In German.

The emission and absorption were determined for an evaporated film of CdS, using a photographic method with a concave grating; experimental details are given. The principal band of S lies at 83.6 A, with weaker bands on the high energy side. The position of the absorption limit is determined and discussed in relation to the distance between the valency and conduction bands. G.F.Lothian

537.531 : 535.34

8019. ELIMINATION OF OVERLAPPING ORDERS IN X-RAY ABSORPTION SPECTRA.
B.Nordfors, L.Rudström and A.E.Sandström.
Ark. Fys., Vol. 12, Paper 7, 259-62 (1957).

The total intensity of X-rays after passage through an absorbing material is in general made up of several parts corresponding to various orders, and in order to secure the absorption spectrum these must be separated. This may conveniently be done by perform ing subsidiary experiments in which the first order is removed by a thick absorbing layer. A.E.I. Research Laboratory

A3

537.531 : 535.33 : 539.2

8020. CALCULATION OF THE STRUCTURE OF THE X-RAY EMISSION SPECTRUM OF ORDERING ALLOYS.
A.N.Orlov and A.V.Sokolov.
Fiz. Metallov i Metallovedenie, Vol. 5, No. 3, 390-4 (1957).
In Russian.

The effect of ordering of a b.c.c. lattice on the L-emission spectrum is calculated on the basis of a one-electron model. As the degree of order increases, the long wavelength (λ) limit moves to higher λ and the short-λ edge to shorter λ. If the alloy has more than one conduction electron per atom there will be a band of forbidden electron energies and a corresponding gap in the emission spectrum which widens as the degree of order increases.

A.F.Brown

537.531 : 535.343 : 548.736.1

8021. FINE STRUCTURES OF X-RAY ABSORPTION SPECTRA OF COBALT IN THE FACE CENTERED CUBIC LATTICE AND CLOSE-PACKED HEXAGONAL LATTICE.
M.Sawada, K.Tsutsumi and A.Hayase.
J. Phys. Soc. Japan, Vol. 12, No. 6, 628-36 (June, 1957).

Samples of cobalt of the α-modification (hexagonal close-packed lattice) and the β-modification (face centred cubic lattice) and their mixtures were prepared, and their crystal structures were examined by X-ray diffraction. Fine structures of the X-ray K absorption spectra of these cobalt samples were photographed by a bent crystal spectrograph and the mass absorption coefficients in the X-ray K absorption spectral region were measured by using a diffraction unit and wide range spectrometer modified with a Geiger–Müller counter. By comparing the photometer curves of these spectrograms or the recorded curves, the fine structures of the absorption spectra of these cobalt samples were found to be very similar. The wavelength values and the mass absorption coefficient of the fine structures of the absorption spectra also nearly coincided within experimental errors, and thus the position and the form of the maximum and minimum of these structures were found to be the same. It is concluded that this is due to the fact that atoms in the α-cobalt have the same immediate surroundings as those in the β-cobalt. A.

537.531 : 535.343

8022. FINE STRUCTURES OF X-RAY ABSORPTION SPECTRA OF CRYSTALLINE AND AMORPHOUS GERMANIUM.
T.Shiraiwa, T.Ishimura and M.Sawada.
J. Phys. Soc. Japan, Vol. 12, No. 7, 788-92 (July, 1957).

The X-ray absorption spectra of crystalline and amorphous germanium were photographed and fine structures at the K absorption edges were observed to 500 eV in the crystalline and to 350 eV in the amorphous state. The shape of the fine structure of amorphous germanium is similar to that of crystalline germanium though the small fluctuations disappear and the energy values measured from the main edge are smaller than the values of corresponding absorption maxima and minima of the crystalline germanium. From the comparison of the fine structures of both states a structure is suggested which is like the diamond lattice of crystalline Ge, with smaller spacing in amorphous Ge. A.

537.531 : 535.343

8023. FINE STRUCTURES OF X-RAY K ABSORPTION SPECTRA OF COPPER IN VARIOUS COPPER COMPOUNDS.
K.Tsutsumi, A.Hayase and M.Sawada.
J. Phys. Soc. Japan, Vol. 12, No. 7, 793-801 (July, 1957).

Fine structures of the X-ray K absorption edges of copper in following compounds were recorded: cupric chloride ($CuCl_2$), cupric chloride dihydrate ($CuCl_2 \cdot 2\ H_2O$), cupric bromide ($CuBr_2$), cupric sulfate pentahydrate ($CuSO_4 \cdot 5\ H_2O$), cupric nitrate trihydrate ($Cu(NO_3)_2 \cdot 3\ H_2O$), cupric carbonate ($CuCO_3$), cupric formate tetrahydrate ($Cu(HCOO)_2 \cdot 4\ H_2O$), cupric acetate monohydrate ($Cu(CH_3COO)_2 \cdot H_2O$), bis glycino copper monohydrate ($Cu(C_2H_4NO_2)_2 \cdot H_2O$), bis glycino copper hydrate ($Cu(C_2H_4NO_2)_2 \cdot H_2O$), copper phthalocyanine β-form ($CuC_{32}H_{16}N_8$), copper phthalocyanine α-form ($CuC_{32}H_{16}N_8$), cuprous chloride (CuCl), cuprous bromide (CuBr) and cuprous iodide (CuI). The recorded curves of the fine structures of the Cu K absorption edges of these compounds, except α- and β-phthalocyanine, were found to be very similar in form, and the wavelength values of these structures also nearly coincided within experimental errors. It is considered that this is due to the fact that the copper atom is surrounded by various kinds of atoms in octahedral configuration in many cases, and in the exceptional case (α- and β-phthalocyanine) in planar configuration. It is concluded that the fine structures of the Cu K absorption edges of these compounds are mainly determined by the immediate surroundings of the atom in question. A.

537.531 : 535.34

8024. THE STRUCTURE OF THE K-ABSORPTION EDGE OF TH ELEMENTS OF DIFFERENT $A_{III}B_V$ COMPOUNDS. W.Eberbeck.
Z. Phys., Vol. 149, No. 4. 412-24 (1957). In German.

The fine structures of the K-absorption edge of Ga in GaP, GaAs and GaSb, of As in GaAs and InAs, of Zn in ZnS and of pure Ge were examined. Inter-comparison of the edge structures only gave good agreement with Kronig's theory within the groups ZnS and GaP, GaAs and Ge, InAs and GaSb. Close to the K-edge of Ga the three Ga compounds showed characteristics that corresponded qualitatively with those expected from electrical measurements.

B.T.M.Willis

537.531 : 539.215.0

8025. THE SMALL-ANGLE SCATTERING OF X-RAYS AND ITS USE FOR PARTICLE SIZE DETERMINATION. V.Gerold.
Z. angew. Phys., Vol. 9, No. 1, 43-55 (Jan., 1957). In German.

A survey of the field. The theory of small-angle scattering is discussed and its application to particle-size determination considered for both monodispersed and polydispersed systems. Practical cases treated include inhomogeneities in metals and alloy A final section deals with experimental methods. J.Thewli

CATHODE RAYS. POSITIVE RAYS

537.533 : 621.385.83

8026. RIPPLING OF THIN ELECTRON RIBBONS. W.E.Waters.
J. appl. Phys., Vol. 29, No. 1, 100-4 (Jan., 1958).

A paraxial equation for thin electron ribbons, or "sheet beams subject to purely electrostatic fields, and including a first-approximation term for the lateral space-charge force, is derived. Solutic of the equation for several cases of practical interest are discusse The effect of the possible curvature of the optical axis is shown to be very important in helping to counteract the divergent space-charge forces.

537.533 : 621.385.83

8027. OPTICAL THEORY OF THERMAL VELOCITY EFFECTS IN CYLINDRICAL ELECTRON BEAMS. G.Herrmann.
J. appl. Phys., Vol. 29, No. 2, 127-36 (Feb., 1958).

The present theory is based on a non-laminar optical model which treats thermal velocities as an integral part of the motion. A Maxwellian distribution of initial transverse velocities is assum at the cathode, and a first-order focusing theory is applied in orde to calculate trajectories at any point in the beam. It is shown that whenever a long beam is confined by a focusing field, images of th cathode are formed repeatedly along the axis. When applied to uni form magnetic focusing fields, the theory predicts the periodic formation along the axis of cathode images and cross-overs, and a relative rotation of successive images. Such effects have been reported. Values of required focusing fields are derived for given space-charge and thermal-velocity conditions, and relations are established between beam spread and transverse velocities. The resulting picture differs radically from the laminar model of beam flow. A

537.5

8028. SMALL SIGNAL POWER CONSERVATION THEOREM FO IRROTATIONAL ELECTRON BEAMS. J.W.Klüver.
J. appl. Phys., Vol. 29, No. 4, 618-22 (April, 1958).

The first-order linearized set of Maxwell–Lorentz equations are used as basis for the derivation of a power conservation theor describing the balance between the r.f. kinetic power and the r.f. electromagnetic power in the electron beam. The theorem applies to laminar electron beams in which the electron flow is irrotationa and the thermal velocity distribution at the cathode surface is neglected. The kinetic power flow is given in terms of the longitud r.f. kinetic potential or the Chu potential, the longitudinal part of t r.f. beam current and the equivalent longitudinal surface current o the beam boundary. This surface current embodies the effect of t transverse r.f. motion in the beam. A short discussion of the appl ation of the theorem to thin beams is given.

537.533 : 537.563 : 621.385.8

8029. NOTE ON POSITIVE-ION EFFECTS IN PULSED ELECTR BEAMS. J.T.Senise.
J. appl. Phys., Vol. 29, No. 5, 839-41 (May, 1958).

Positive-ion effects were observed in pulsed electron beams short duration (0.5 to 5 μsec), under conditions of operation norma encountered in high-power microwave tubes. Three different aspe of ion effects were studied: beam focusing, ion oscillations, and i

rapping at scallop minima. Experimental results are given and correlated with previous work on ion effects by other authors. A.

537.533 : 621.385.833

8030. PERVEANCE AND THE BENNETT PINCH RELATION IN PARTIALLY NEUTRALIZED ELECTRON BEAMS. J.D.Lawson.
J. Electronics and Control, Vol. 5, No. 2, 146-51 (Aug., 1958).

The concept of perveance as applied to electron beams with no electric field in the direction of flow is extended by a simple generalization to include relativistic conditions and the effect of space-charge neutralization. For self-constricted beams this generalized perveance K is negative, and relates the root mean squared transverse velocity in the beam to the drift velocity. In this respect the perveance relation is virtually the same as the Bennett pinch relation $I^2 = 2Nk(T_e + T_i)$; indeed if T is suitably defined the two relations are identical for beams which are completely neutralized by stationary ions. Finally some properties of electron beams are compared with those of current carrying plasma columns. A.

537.533 : 621.385.833

8031. CURRENT AND VELOCITY FLUCTUATIONS AT THE POTENTIAL MINIMUM. F.N.H.Robinson.
J. Electronics and Control, Vol. 5, No. 2, 152-6 (Aug., 1958).

The fluctuations in temperature-limited emission are shown to be uncorrelated. Space-charge smoothing leaves the velocity fluctuations unchanged, but at low frequencies even moderate degrees of smoothing lead to complete correlation of the two fluctuations. A.

537.533

8032. ELECTROSTATIC ELECTRON ACCELERATOR WITH STRONG FOCUSING. K.Maurer, T.Springer and H.Maier-Leibnitz.
Z. angew. Phys., Vol. 9, No. 12, 597-600 (Dec., 1957). In German.

A linear accelerator with a Van de Graaf high-voltage source is described which uses electrostatic alternating gradient focusing. At 1.2 MeV a current of 0.2 mA is obtained. H.Motz

537.533 : 537.534 : 539.1.07

8033. A TEST PULSE GENERATOR FOR USE WITH THE HARWELL 15 MeV LINEAR ACCELERATOR AND THE ASSOCIATED NEUTRON TIME-OF-FLIGHT EQUIPMENT. F.W.K.Firk.
Atomic Energy Res. Establ. (Harwell) Rep. NP/R2043, 11 pp. (1956).

The duration of the timing channels can be measured to an accuracy of ± 20 mμsec under working conditions. Provision is also made for the determination of the true "zero-of-time" for the spectrometer: a coincidence technique is used to assess the distribution in time of individual neutron pulses from the machine. A.

537.533 : 537.534

8034. A DESIGN FOR A STRUCTURE FOR ACCELERATION OF PROTONS FROM 150 TO 600 MeV. P.D.Dunn and D.J.Thompson.
Atomic Energy Res. Establ. (Harwell) Rep. GP/R 2000, 10 pp. 1957).

Detailed measurements on certain types of coupling are summarized, and a choice of coupling device is made for use in a proton linear accelerator structure consisting of x-mode pill-box resonators. A model (resonant at 3000 Mc/s) of a section of such a machine was constructed, and its r.f. properties were investigated and compared with theory. A.

537.533 : 537.534

8035. SPIRAL RIDGE CYCLOTRONS WITH FREQUENCY MODULATION. L.B.Mullett.
Atomic Energy Res. Establ. (Harwell), Rep. GP/R2069, 13 pp. (1956).

In order to avoid phase-slip and resonances in radial oscillations, a spiral-ridge cyclotron can be operated with frequency modulation. The characteristics of such machines are considered in detail, with emphasis on the maximum trapping range and duty cycle of operation. A.

537.533 : 537.534

8036. ACCOUNT OF COLLECTIVE INTERACTION OF ELECTRONS IN CYCLIC ACCELERATORS.
V.M.Kovrizhnykh and A.N.Lebedev.
Zh. éksper. teor. Fiz., Vol. 34, No. 4, 984-92 (1958). In Russian.

A mathematical technique is developed which permits one to take into account collective interaction of particles in cyclic accelerators. The method is applied to the problem of capture of electrons under betatron acceleration conditions. The results obtained are compared with experiment. A.

537.533 : 537.534 : 621.384.611

8037. MICROTRON. A.Paulin.
Elektroteh. Vestnik, Vol. 25, No. 9-10, 341-5 (Sept.-Oct., 1957). In Slovene.

A microtron design including a double magnet is described. It is shown that no special difficulties in focusing and phase selection arise in consequence of division of the magnetic field. The air gap of the magnet may be reduced by an order of magnitude, thereby yielding about ten times as much energy as that furnished by the ordinary microtron at the same cost of the magnet. Such an accelerator would be very useful for electron energies of up to several hundreds of MeV. A.

537.533

8038. ELECTRON ORBITS IN HYPERBOLIC MAGNETIC FIELDS. E.Åström.
Tellus, Vol. 8, No. 2, 260-7 (May, 1956).

Electron motion in the field of cylindrical pole-pieces, with the section in the shape of a rectangular hyperbola and its conjugate, is treated. The accessible region is discussed. For the motion in the asymptote planes to the hyperbola the orbits are characterized by two parameters: one (k) characterizing the shape, and the other the amplitude. The solution is given in elliptic functions. The orbits may be divided into two groups, one composed of orbits resembling trochoids and the other orbits of a meander type. There exists a periodic orbit similar to the digit 8. The drift is in opposite directions on different sides of this orbit, as characterized by k. The trochoidal motion is stable if the orbit is not stretched too much. For the meander orbits the criterion used gives a main stability region. This region is bounded by the periodic orbit and the orbit the branches of which just touch each other. For both groups of orbits there exists an infinite number of stable regions. A.

537.533.1

8039. A CONTRIBUTION TO THE IMPROVING OF THE RESOLUTION OF ELECTROSTATIC VELOCITY ANALYSERS. W.Dietrich.
Z. Phys., Vol. 151, No. 5, 519-35 (1958). In German.

The optimum design of an electrostatic electron-velocity analyser is discussed in some detail. An instrument is described with a sensitivity of 0.05 eV. The measured resolution is 0.25 eV, limited by the energy distribution of the primary electrons and not by the electron-optical design. A.E.I. Research Laboratory

537.533.3

8040. MAGNETIC DEFLEXION OF ELECTRON BEAMS WITHOUT ASTIGMATISM. G.D.Archard and T.Mulvey.
J. sci. Instrum., Vol. 35, No. 8, 279-83 (Aug., 1958).

An electron beam passing through a magnetic deflecting field is, in general, subject to astigmatism. For circular pole-pieces, this takes the form of focusing in the plane of deflection; for square pole-pieces, focusing perpendicular to the plane of deflection. Deflection free from astigmatism can be achieved by means of circular pole-pieces from which semi-circular portions have been removed. An application of this to reflection electron microscopy is described. A.

537.533.3 : 621.385.1.029.6

8041. ELECTRON TRAJECTORIES IN THE GUN OF AN M-TYPE CARCINOTRON. D.H.Davies and K.F.Sander.
J. Electronics and Control, Vol. 5, No. 2, 114-28 (Aug., 1958).

Modification to an automatic electron trajectory tracer (see Abstr. 2/1957) are described to permit tracing of paths in crossed electric and magnetic fields when the system is of planar symmetry. The modified tracer is used to investigate the beam shape in an M-type Carcinotron. Optimum operating voltages are suggested with the given geometry. A modification to the electrode geometry is described which would lead to further improvement. A.

537.533.3

8042. THE ABERRATION OF AXIALLY SYMMETRICAL ELECTRON-OPTICAL SYSTEM IN PRESENCE OF SPACE CHARGES. Yao Fu-Den.
Scientia Sinica, Vol. 7, No. 1, 31-44 (Jan., 1958).

Formulae for aberrations in electron-optical systems beset by appreciable space charge are derived in a form more easily adapted to numerical evaluation than those of earlier workers. The contribution of space charge to the aberrations is separated from the geometrical contributions and this offers hope of application to correction systems. A.E.I. Research Laboratory

537.533.3

8043. IN CONNECTION WITH THE CRITICISM BY P.P.KAS'YANKOV OF MY METHOD OF OBTAINING THE PRINCIPAL ELECTRON-OPTICAL EQUATIONS FOR BEAMS WITH A CURVILINEAR AXIS. G.A.Grinberg.
Zh. tekh. Fiz., Vol. 27, No. 10, 2425-31 (1957). In Russian.
English translation in: Soviet Physics - Technical Physics (New York),Vol. 2, No. 10, 2259-65 (Oct., 1957).

The author discusses step by step the various objections raised by Kas'yankov in his book "Theory of electromagnetic systems with a curvilinear axis" (Leningrad University, 1956), and disproves them by showing that Kas'yankov's conclusions are based on erroneous premises, in the first place on the identification of the local system of Cartesian coordinates x, y, z with the curvilinear system s, p, q used by Kas'yankov. As a matter of fact, a correct treatment of the author's equations yields exactly the equations derived by Kas'yankov. In a note appended during proof-reading the author deals in the same way with Kas'yankov's criticism contained in a later paper (Optika i Spektrosk., Vol. 3, No. 2, 169-79, 1957).
F.Lachman

537.533.3

8044. IN CONNECTION WITH THE LETTER OF PROFESSOR G.A.GRINBERG. P.P.Kas'yankov.
Zh. tekh. Fiz., Vol. 28, No. 4, 915-18, 19 (1958). In Russian.

A reply to G.A.Grinberg's letter (see preceding abstract). The author maintains his criticism (Optika i Spektrosk., Vol. 3, No. 2, 169-79, 1957) of Grinberg's method described in the latter's book on selected problems of the mathematical theory of electric and magnetic phenomena. The polemics are terminated by the editor who believes that it was begun owing to a misunderstanding on the part of the author. F.Lachman

537.533.35

8045. DIRECT IMAGING OF METAL SURFACES BY MEANS OF ELECTRONS RELEASED BY ION BOMBARDMENT. W.Bayh.
Z. Phys., Vol. 151, No. 3, 281-95 (1958). In German.

The paper describes improvements in the design of the ion-microscope developed at Tübingen University. These include an improved ion gun and the use of a bombardment angle of 10° with respect to the specimen plane. The resolving power is now 500 A. One application of the present instrument is in identifying inclusions in metals. A.E.I. Research Laboratory

537.533.35

8046. A HIGH RESOLUTION EMISSION MICROSCOPE FOR VIEWING SURFACES BY MEANS OF ELECTRONS RELEASED BY U.V. RADIATION. W.Koch.
Z. Phys., Vol. 152, No. 1, 1-18 (1958). In German.

An instrument is described in which photo-electrons are released from a specimen by a beam of u.v. light. An electrostatic lens system operating at 40 kV is then used to form an electron image of the surface. A resolution of 1000 A was obtained by this method.
A.E.I. Research Laboratory

537.533.35

8047. CORRECTION OF SPHERICAL ABERRATION IN SHORT-LENS β-SPECTROMETERS. A.Gelberg.
Stud. Cercetări Fiz., Vol. 9, No. 1, 31-8 (1958). In Roumanian.

Calculates the compensation of the spherical aberration of a short magnetic lens by means of a toroidal compensating coil. The iconal of the lens is completed by adding a term relating to the effect of the compensating coil. The calculation is carried out for a point-like object placed on the main axis of the lens. It is assumed that the field of the lens is roughly bell-shaped. F.Lachman

537.533.7 : 621.385.832

8048. ELECTRON-PERMEABLE WINDOW FOR CATHODE-RAY TUBES. J.Seehof, S.Smithberg and M.Armstrong.
Rev. sci. Instrum., Vol. 29, No. 9, 776-8 (Sept., 1958).

An ultra-thin window, permeable to low-energy electrons, was developed for use with cathode-ray tubes and associated devices. This window, some 70 μin. thick, has the ability to withstand greater than 1 atm pressure differential and, at the same time, allow a 15 kV electron beam to penetrate it. Window structures are composed of a $\frac{1}{4}$ in. square matrix (80-mesh nickel screen) supported bentonite clay film. It is expected that larger area configurations can be developed. The films are relatively gas-tight and are insensitive to temperatures of at least 400°C. A.

537.533.74 : 539.2

8049. CYCLOTRON RESONANCE: METHOD FOR DETERMINING COLLISION CROSS SECTIONS FOR LOW-ENERGY ELECTRONS. D.C.Kelly, H.Margenau and S.C.Brown.
Phys. Rev., Vol. 108, No. 6, 1367-71 (Dec. 15, 1957).

The Boltzmann transfer equation is solved for the distribution function of electrons moving under the influence of a constant magnetic field and a high-frequency electric field. The power absorbed from the microwave is calculated for the two usual assumptions: (a) constant mean free time, and (b) constant mean free path. For the case of constant mean free time, the absorption spectrum exhibits a "Lorentzian" resonance peak. The half-width of this line gives a direct measure of the collision frequency. Experimental data in support of this result are presented. The constant mean free path assumption leads to integrals which can be evaluated closely by the saddle-point method, and the results are presented in graphical form. It is found that the line shape is not very sensitive to the dependence of the collision cross-section upon electron velocity. A

537.533.75

8050. THE PENETRATION OF ELECTRONS INTO GERMANIUM AND SILICON [AND INDIUM AND ANTIMONY]. B.Ya.Yurkov.
Zh. tekh. Fiz., Vol. 28, No. 6, 1159-64 (1958). In Russian.

Curves giving the rate of energy loss for fast electrons (0.005-5 MeV) in Ge, Si, In, and Sb, are computed using the theory of Spencer (Abstr. 7117/1955). The results are in reasonable acco with the experimental data of Bul et al. (Atomnaya Energiya, Vol. 2 533, 1957) on electron–hole pair formation in Ge. K.F.Hulm

537.533.8

8051. RADIATION FROM AN ELECTRON TRAVERSING A SLAB V.E.Pafomov.
Zh. éksper. teor. Fiz., Vol. 33, No. 4(10), 1074-5 (1957). In Russia
English translation in: Soviet Physics — JETP (New York), Vol. 6 No. 4, 829-30 (April, 1958).

The results are given for the distribution of radiation emitted by an electron normally incident on a dielectric slab of finite thickness, and these are discussed. The most important features, not present in the calculation of Ginzburg and Frank for a semi-infinite medium, arise from interference effects. G.H.Burkhardt

537.533.

8052. SECONDARY ELECTRON EMISSION DUE TO BOMBARDMENT BY 1-4 MeV DEUTERONS. A.I.Akishin.
Zh. tekh. Fiz., Vol. 28, No. 4, 776-8 (1958). In Russian.

The relationship between the secondary-emission factor γ and the energy of deuterons E was studied. Activated and untreated alloys Cu–Be (~ 2% Be), Cu–Mg (~ 4% Mg), Al–Mg (~ 4% Mg), thin layers of Be evaporated on Ni supports, BeO and unalloyed Cu and Ni were used as the targets. In all cases γ decreased with increasing E. Activation of the alloy targets increased γ by a factor of 2. M.H.Slobod

537.533.

8053. ON THE ACTION OF ELECTRONS ON MULTILAYERED PHOTOGRAPHIC FILMS. N.G.Sushkin and Yu.M.Kushnir.
Zh. tekh. Fiz., Vol. 28, No. 4, 908-9 (1958). In Russian.

It is shown that the exposure of a multilayered colour film to electrons of various velocities (30 to 80 keV) leads to varying colo ation of the film, and that the colour depends on the electron veloci W.O.Loc

537.5

8054. THE 160 keV DEUTERON ACCELERATOR OF THE I.N.F.N. AT MILAN. L.Colli, S.Micheletti and C.Salvetti.
Nuovo Cimento, Vol. 9, No. 3, 538-44 (Aug. 1, 1958). In Italian.

The electrostatic accelerator of the Physics Institute of the University of Milan is described. This instrument was designed to be used as a 14 MeV neutron source by means of the reaction $D + T = {}^{4}_{2}\alpha + {}^{1}_{0}n + 17.587$ MeV. A total flux of 5×10^{9} neutrons/sec can be obtained, with the accelerating potential of 150 kV.

537.534

8055. ION IMAGES IN TRANSMISSION.
G.Möllenstedt, H.Seiler and G.Junger.
Z. Phys., Vol. 150, No. 1, 16-20 (1958). In German.

The image-converter microscope for X-rays (Abstr. 3169/195 has been modified for primary illumination with Li ions. The specimen is placed on a thin carbon film, the other side of which carries an evaporated layer of silver 500 A thick. When the speci men is bombarded with Li ions of 70 kV, secondary electrons are emitted from the silver film and are focused by an electrostatic immersion objective (at 40 kV) at a direct magnification of 80 x. Images of sodium dodecylsulphate and muscovite obtained in this way are compared with electron micrographs of the same areas. The main features of the images are identical, except that no Brag diffraction effects are found with ions. Although the resolving pow

h ions is worse than with electrons, the new method will provide ormation about the interaction of ions with matter, particularly arding energy loss and absorption. V.E.Cosslett

537.534.3

6. A THREE STAGE MASS SPECTROMETER.
.White, F.M.Rourke and J.C.Sheffield.
l. Spectrosc., Vol. 12, No. 2, 46-52 (1958).
A three-stage mass spectrometer, utilizing two consecutive gnetic focusing lenses of 20 in. radii, followed by a 20 in. radius of vature electrostatic analyser, is described. An abundance sensity of 10^{10} was measured for this instrument in the low mass ion. Application of this instrument to analytical and research blems in the field of mass spectrometry and results obtained discussed. A.

537.534.3

7. A MASS SPECTROMETER MASS MARKER.
.Beynon and S.Clough.
sci. Instrum., Vol. 35, No. 8, 289-91 (Aug., 1958).
An instrument has been constructed which utilizes the vanomagnetic effect in bismuth to measure the field strength of ass spectrometer magnet, and hence to determine the masses of ks as they occur when the spectrum is scanned by variation of magnetic field strength at constant accelerating voltage. The muth coil is mounted between the pole-pieces of the magnet and instrument marks on the mass spectrum a series of fifty mass lbration points at predetermined values of bismuth resistance hence of magnetic field. Masses can be determined with the trument to ±0.05 mass unit in the range up to mass 200 and to an uracy of ±0.025% above this range. A.

537.534.3

8. RESONANCE MASS SELECTOR. A.Bierman.
. sci. Instrum., Vol. 28, No. 11, 910-13 (Nov., 1957).
A device is proposed with which ions may be selected on ount of their oscillating frequency in a static "potential well", reby the ions pass several times across the same r.f. field ed to the oscillation, thus gaining energy on each passage. No gnetic fields are used. As the initial velocity of the ions plays y a secondary role for the selection, the energy spread in the ion rce is allowed to be much greater than with most types of mass ctrometers. Likewise, no high mechanical precision is required. e resolving power may be varied by electrical means. "Harmonic sses" ("ghost images") are easily eliminated. A.

537.534.3 : 539.18

9. THE ELECTRIC MASS-FILTER AS MASS SPECTROTER AND ISOTOPE SEPARATOR.
Paul, H.P.Reinhard and U.von Zahn.
Phys., Vol. 152, No. 2, 143-82 (1958). In German.
An electric quadrupole lens is used as a mass spectrometer by cing alternating potentials across the electrode pairs. A resolon of 1500 is obtained in agreement with theory. The method can o be used in isotope separation.
A.E.I. Research Laboratory

537.534.3 : 551.510.535

MASS DETERMINATION OF [IONOSPHERIC] IONS. See tr. 7624

537.534.8

0. INTERACTION OF RARE GASES WITH A TUNGSTEN RFACE. G.Ehrlich, T.W.Hickmott and F.G.Hudda.
hem. Phys., Vol. 28, No. 5, 977-8 (May, 1958).
Describes experiments in the field emission microscope showthat, for emitter temperatures below a few hundred °K, bombardnt by the ions of argon, krypton and xenon reduces the work func- of the tunsten emitter. Sputtering is ruled out as a mechanism ause annealing restores the initial surface state. The binding rgy for xenon is of the order 7 kcal/mole and changes of work ction of over 1 eV are observed, first the 100 plane and then the plane being influenced. A.H.W.Beck

537.534.8

1. ON THE DEPENDENCE OF SECONDARY EMISSION OF GATIVE IONS ON THE ANGLE OF INCIDENCE OF PRIMARY OTONS WITH THE SURFACE OF A METALLIC TARGET.
I.Mitropan and V.S.Gumenyuk.
. éksper. teor. Fiz., Vol. 34, No. 1, 235-6 (1958). In Russian.
A graph is given of the results for 50 keV protons on Cu, Al, and stainless steel. W.O.Lock

537.534.9 : 539.21

IONIC BOMBARDMENT CLEANING OF GLASS. See Abstr. 7523

DISCHARGE TUBES. IONIZATION. THERMIONICS

537.542

8062. AN ELECTRON BOMBARDMENT ION SOURCE.
D.Blanc and A.Degeilh.
C.R. Acad. Sci. (Paris), Vol. 246, No. 6, 936-9 (Feb. 10, 1958). In French.
Describes a modified Nier source, in which ionization is caused by electron bombardment of the gas used, without the usual collimating magnetic field. The voltages on the various electrodes are given, with a schematic illustration and curves of ion current yields, etc.
J.D.Craggs

537.542

8063. THE EFFICIENT USE OF A MAGNETIC FIELD IN HIGH-FREQUENCY PROTON SOURCES. M.D.Gabovich.
Zh. tekh. Fiz., Vol. 28, No. 4, 872-80 (1958). In Russian.
The effect of a transverse magnetic field on a discharge supported by externally applied r.f. excitation is considered. It is shown that the presence of the field not only facilitates the introduction of power into the discharge region, but also leads to a more effective use of this power. The magnetic field introduces an anisotropy in the distribution of the ion current. This effect was used in a design of an ion source. Some experimental results obtained with this source are given. S.Chomet

537.56/.57

8064. EQUILIBRIUM IONIZATION OF PARTICLES.
A.A.Arshinov and A.K.Musin.
Dokl. Akad. Nauk SSSR, Vol. 120, No. 4, 747-50 (1958). In Russian.
General solution of the problem of equilibrium ionization of particles is derived. The solution covers all cases from multiple ionization of atoms to ionization of macroscopic particles.
S.Chomet

537.56

8065. ON THE STATISTICS OF PLASMAS.
P.S.Plütter and F.Sauter.
Ann. Phys. (Leipzig), Folge 7, Vol. 1, No. 1-3, 4-15 (1958). In German.
With the help of Liouville's theorem the basic dynamical equations for a classical statistics of plasmas are deduced. These equations which must be satisfied by the distribution function consist of a system of partial differential equations. The Maxwell equations can be derived from these basic equations.
J.D.Craggs

537.56

8066. MACROSCOPIC FOUNDATION OF PLASMA DYNAMICS.
T.Kihara.
J. Phys. Soc. Japan, Vol. 13, No. 5, 473-81 (May, 1958).
A fluid which comprises several species of charged and neutral particles is treated macroscopically. Basic equations, energy and momentum theorems, and law of similarity are discussed. The condition under which the current equation reduces to the usual form is considered; and one-dimensional transverse waves are treated as an example. Quasi-stationary phenomena are examined as a particular case; and it is pointed out that one of the usual basic equations of hydromagnetics, Ohm's law $J = \sigma(E + v \times B)$, should be replaced by $\mathrm{rot}(E + v \times B - \sigma^{-1}J) = 0$, v being the velocity of the mean mass flow. An axially symmetric solution is obtained and applied to a self-pinched column, whose stability is explained in an elementary manner. A.

537.56

8067. EXTERNALLY PINCHED PLASMA.
T.Ohkawa and T.Kihara.
J. Phys. Soc. Japan, Vol. 13, No. 5, 482-3 (May, 1958).
A new process of pinching a plasma column is treated theoretically. A column of plasma with no longitudinal current can be pinched by an external magnetic field parallel to the column; and the plasma thus pinched will show no instability. The process depends on the effective value of γ, the ratio of specific heats. For $\gamma = 2$ in particular, the temperature of a perfectly conducting plasma with no heat loss will rise in proportion to the external magnetic field. A.

537.56 : 538.56

8068. NON-LINEAR THEORY OF PLASMA OSCILLATIONS AND WAVES. S.Amer.
J. Electronics and Control, Vol. 5, No. 2, 105-13 (Aug., 1958).

A non-linear equation for plasma oscillations is derived. Only Coulomb interactions between electrons are considered. From an exact first integration the following properties are found: There is an asymmetry in the oscillations expressed by $\rho_{max} = a_0 + a_0^2/3n_0$ and $\rho_{min} = -a + a_0^2/3n_0$, where ρ is the density of electrons. There is also a dependence of the frequency on the amplitude of the oscillations. The uniform equilibrium distribution of electrons is found to be highly stable. A second approximate integration gives the explicit form of the oscillations

$$\rho = [a_0 \sin\omega t - a_0^2/2n_0]/[1 - (a_0 \sin\omega t)/n_0],$$

and the dependence of the frequency on the amplitude $\omega = (1 - a_0^2/n_0^2)^{1/2}\omega_p$. If collisions between electrons are ignored, instead of progressive waves there are stationary plasma waves. The form of these is found for the case of spherical waves in an isotropic plasma. A non-linear approximate equation is found and an exact solution of this equation is obtained. A suitable approximation to this solution is $\rho = A \cos(B/r)$. The approximations used to find the equation are, however, very rough and this second part should be considered only as tentative. A.

537.56 : 538.12

8069. EFFECT OF CHARGE SEPARATION ON PLASMA DIFFUSION IN A STRONG MAGNETIC FIELD. A.N.Kaufman.
Phys. of Fluids, Vol. 1, No. 3, 252 (May-June, 1958).

Gives a generalization of Simon's treatment (Abstr. 2142/1956) which shows that in a system isolated to allow charge separation the resultant electric field grows to a value which destroys diffusion across the magnetic field caused by ion–ion collisions. The ratio of flux from like-particle collisions to that from unlike-particle collisions is in general negligible. C.G.Morgan

537.56

8070. CALCULATION OF FIELDS ON PLASMA IONS BY COLLECTIVE COORDINATES. A.A.Broyles.
Z. Phys., Vol. 151, No. 2, 187-201 (1958).

The probability of finding a given electric field on an ion in a plasma is computed with the aid of the collective coordinates. All the ions are assumed to have the same charge, and the free electrons are replaced by a rigid negative smear. The Jacobian of the transformation to collective coordinates is expanded in a series of Hermite polynomials, and one of the higher terms is computed as an estimate of the error. This error calculation indicates that a lower limit in the temperature probably exists below which present methods may not be used. This lower limit depends upon the form of the short range potential that is chosen. A cut-off in space at a particle separation of r_C is employed in place of the cut-off in wave-number at k_C. An average short-range potential as a function of temperature appears. The values of the probability are shown to be surprisingly insensitive to the value of r_C at infinite temperature and to compare well with the Holtsmark distribution. A.

537.561

8071. CALCULATED CALIBRATION POINTS FOR NEGATIVE ION APPEARANCE POTENTIALS. L.M.Branscomb.
J. chem. Phys., Vol. 29, No. 2, 452-3 (Aug., 1958).

The author calls attention to the existence of sufficient precise spectroscopic data to permit the calculation of the appearance potentials of zero-energy, negative, oxygen ions in CO, NO, and O_2 to an accuracy of about ±0.02 eV. However, for D(CO) the spectroscopic value might be too high by perhaps 100 cm^{-1} if the dissociation limit given by Douglas and Møller (Abstr. 3927/1955) corresponds to a process producing components of higher energy than the lowest levels assumed in their analysis. R.Schnurmann

537.562

8072. INVESTIGATION OF AN IONIZED GAS BY MEANS OF WEAK ELECTRICAL ALTERNATING FIELDS. A.Székely.
Acta phys. Austriaca, Vol. 12, No. 1, 91-107 (1958). In German.

Using the alternating field method which involves the measurement of conductivity and capacity of a condenser filled with an ionized gas, the properties and type of charge carriers were examined. With a cathode glow discharge in helium at 0.5 mm Hg, the development of various discharge conditions with gradually increasing voltage is followed. By covering a large frequency range from 0.02 to 14 Mc/s, an analysis of the conduction values was made possible. The individual contribution by the various types of free electrons and their density were determined. A.E.D.Heylen

537.562

8073. THE SECOND APPROXIMATION TO THE MOBILITIES OF IONS IN GASES. A.Dalgarno and A.Williams.
Proc. Phys. Soc., Vol. 72, Pt 2, 274-6 (Aug., 1958).

Considers the correction term ϵ_0 in the Chapman–Enskog formula for the diffusion coefficient of ions in their parent gases. Values of ϵ_0 are tabulated for various values of n (the interaction potential is proportional to $\pm R^{-n}$) and for Li^+ in He and He^+ in He. J.D.Craggs

537.562 : 537.222

FLUX OF IONS CAPTURED BY CONDUCTING ELLIPSOIDS AND ELLIPTICAL CYLINDERS IN AN ELECTRIC FIELD WITH FREE IONIZATION. See Abstr. 7878

537.564

8074. TIME DELAY BETWEEN HIGH-SPEED PELLETS AND ASSOCIATED LUMINOSITY AND IONIZATION.
P.E.Tucker, R.A.Davidson and W.S.Partridge.
J. appl. Phys., Vol. 29, No. 7, 868-70 (May, 1958).

An experimental investigation of the luminosity of, and ionization in, the trails of Al and Mg pellets travelling at velocities between 1 and 3 km/sec, is reported. It is concluded from the results (shown graphically) that luminosity and ionization occur at measurable times (about 10 to 300 μsec) after the passage of the pellets, the luminosity appearing first. The peak relative ion density and luminous intensity depend on the speed but not the material of the pellet. J.Dutton

537.564

8075. FORMATION OF NEGATIVE IONS IN GASES BY SECONDARY COLLISION PROCESSES. E.E.Muschlitz, Jr.
J. appl. Phys., Vol. 28, No. 12, 1414-18 (Dec., 1957).

Experiments on the formation of negative ions by electron bombardment of hydrogen, oxygen, and water vapour at pressures of 0-4 mm are described. The only ion observed in hydrogen is H^-, formed by dissociative attachment. Pressure dependence of the O_2^- intensity shows that a secondary collision is involved in its formation. Data on the formation of O^- and O_2^- at low electron energies indicate that the secondary collision leading to the formation of O_2^- does not involve an O^- ion. The formation of O_2^- probably involves a stabilizing collision with a molecule of gas after the initial formation of the ion by electron attachment. From the behaviour of H^-, O^-, and OH^- intensities with H_2O pressure, it is shown that the secondary process for the formation of OH^- in water vapour is probably $H^- + H_2O \rightarrow OH^- + H_2$. The cross-section for this reaction is more than 10^{-17} cm^2. A.

537.564

8076. CHARGE PERMUTATION BY ION-MOLECULE COLLISION. C.E.Melton.
J. chem. Phys., Vol. 28, No. 2, 359-60 (Feb., 1958).

Positive ion-molecule and negative-ion molecule collisions in formic acid were investigated with a mass spectrometer. It is found that both positive and negative ion fragments can be produced by collision-induced dissociations of either positive, ($HCOOH^+$), or negative, ($HCOO^-$), ions. W.Good

537.564

8077. IONIZATION OF MOLECULAR HYDROGEN BY H^+, H_2^+ AND H_3^+ IONS. V.V.Afrosimov, R.N.Il'in and N.V.Fedorenko.
Zh. éksper. teor. Fiz., Vol. 34, No. 6, 1398-405 (1958). In Russian.

The composition of secondary ions produced in single collisions between primary H^+, H_2^+ and H_3^+ ions with energies from 5 to 180 keV and H_2 molecules was studied. The total cross-section for electron capture by the primary ions, σ_0, the total cross-section for formation of free electrons, σ_-, and the cross-sections for production of slow secondary H_2^+ ions, $\sigma_{H^+_2}$, and protons, σ_{H^+}, were determined. Throughout the investigated energy region the cross-section σ_{H^+} was found to be much smaller than $\sigma_{H^+_2}$. Peaks were detected on the curves $\sigma_{H^+_2}(v)$ for primary H^+ and H_2^+ ions at velocities of 1.7×10^8 cm/sec and 1.9×10^8 cm/sec respectively. The value of the cross-section at the peak was $\sim 5 \times 10^{-17}$ cm^2 which is approximately 100 times larger than the corresponding cross-section in the case of an electron impact. A.

537.565 : 532.5 : 538.3

MAGNETOHYDRODYNAMIC WAVES IN AN IONIZED GAS. See Abstr. 7202

537.565 : 532.584

MOTION AND ACCUMULATION OF IONS IN TURBULENT FLOWS. See Abstr. 7736

537.568

78. RECOMBINATION IN THE AFTERGLOWS OF ARGON ID HELIUM USING MICROWAVE TECHNIQUES. C.Sexton and J.D.Craggs.
Electronics and Control, Vol. 4, No. 6, 493-502 (June, 1958).

A similar technique to that of Biondi and Brown (see Abstr. 15/1949) was employed with 3 cm instead of 10 cm microwaves. combination coefficients of approximately 8×10^{-7} cm^3/(ion sec) argon and 7×10^{-8} cm^3/(ion sec) for helium were obtained, in ad agreement with the previous microwave work. The variation this coefficient with power is discussed. It is suggested that re might be a fundamental limitation of the microwave method for recombination coefficients. D.Walsh

537.568 : 537.525

79. CONCENTRATION OF NEGATIVE IONS IN THE PLASMA A POSITIVE COLUMN. M.V.Konyukov.
. éksper. teor. Fiz., Vol. 34, No. 4, 908-11 (1958). In Russian.

The concentration of negative ions in a positive column is nsidered. The effect of volume recombination of positive and gative ions on the concentration of the latter near the discharge is is investigated. A.

537.583 : 621.385.032.213.13

80. USE OF OXIDE CATHODES IN DEMOUNTABLE VACUUM STEMS. G.A.Haas and J.T.Jensen, Jr.
v. sci. Instrum., Vol. 28, No. 12, 1007-10 (Dec., 1957).

A method is described whereby the life of an oxide cathode can substantially increased when subjected to repeated air exposures. is is accomplished by preventing the hydrate formation, and consequently reducing flaking of the cathode coating. Further limitations cathode life caused by the effects of poisoning are also discussed. A.

537.583

81. THE ANOMALOUS EMISSION SATURATION OF FECTIVE THERMOCATHODES. Ya.P.Zinherman.
rayin. fiz. Zh., Vol. 1, No. 2, 134-42 (1956). In Ukrainian with mmary ($\frac{1}{2}$ p.) in Russian.

Measurements are given for a set of current-voltage characteristics at constant cathode temperature for various interelectrode stances for both an oxide and an L-cathode. In the region of omalous saturation it is shown that the anode current is a single-ued function of the product $kV_a^{3/2}$ (k is a constant depending on geometry of the system). The cause of anomalous saturation is own not to be the Shottky effect but a mechanism of partial ission saturation on the surface of the thermocathode which is n-uniform with respect to the work function. C.R.S.Manders

537.585

82. THERMIONIC IONS FROM HYDROGEN PALLADIUM. H.Bachman and P.A.Silberg.
appl. Phys., Vol. 29, No. 8, 1266-7 (Aug., 1958).

A mass spectrometer employing the magnetron principle is scribed, and applied to the investigation of thermal proton emission from a heated Pd tube into which hydrogen may be admitted. was found that both H_1 and H_2 ions are emitted, but the method is sufficiently accurate to allow a determination of the relative ensities. C.H.B.Mee

COSMIC RAYS

537.591

83. CHARGE SPECTRUM, MEAN FREE PATHS, AND FLUX HEAVY PRIMARY COSMIC RAYS AT THE TOP OF THE MOSPHERE. O.B.Young and F.E.Harvey.
ys. Rev., Vol. 109, No. 2, 529-32 (Jan. 15, 1958).

This investigation is restricted to primary cosmic rays of clear charges equal to or greater than ten at the geomagnetic itude of 41°N. Data were obtained from thick emulsions exposed high altitudes over Texas. The flux, extrapolated to the top of the nosphere, was found to be 2.65 ± 0.3 particles/(m^2 sec sterad). e distribution histogram for the charge spectrum is included. The enuation mean free paths for three groups were 28.5 ± 2.8, 7 ± 2.9, 23.6 ± 3.7 g/cm^2 for Z = 10-11, 12-14, 15-26, respectly. A.

537.591

84. ACCELERATED DUST GRAINS AND THE HIGHEST OSMIC RAY ENERGIES. N.Herlofson.
llus, Vol. 8, No. 2, 268-73 (May, 1956).

The events following the impact of a fast ionized grain with the atmosphere are examined, and some similarity is found between the expected air shower and observations of the largest cosmic-ray showers. It is concluded that the largest air showers are in any case initiated by primaries accelerated outside the solar system, whether the primaries are dust grains or single nuclei. A.

537.591.1

8085. STUDY OF THE NUCLEONIC COMPONENT OF COSMIC RADIATION RECORDED IN EMULSIONS WHOSE DIRECTION WAS FIXED WITH RESPECT TO THE SOLAR SYSTEM. S.Desprez.
Ann. Phys. (Paris), Sér. 13, Vol. 3, No. 3-4, 230-57 (March-April, 1958). In French.

No variation was found, within the statistical limits, in the directional distribution with respect to the sun, of 3563 tracks recorded in nuclear emulsions exposed at 1912 m above sea-level. P.Rothwell

537.591.1

8086. ON SOME SOURCES OF THE LOW-ENERGY ELECTRON—PHOTON COMPONENT OF THE COSMIC RAYS IN THE STRATOSPHERE. I.D.Rapoport.
Zh. éksper. teor. Fiz., Vol. 34, No. 5, 1306-9 (1958). In Russian.

It is shown that part (20-30%) of the low-energy electron flux (range $R < 1.7$ g cm^{-2} of Al) observed in the cosmic radiation in the stratosphere is genetically related to the products of nuclear disintegrations. A.

537.591.15

8087. DISTRIBUTION OF K-MESONS PRODUCED IN HIGH ENERGY NUCLEAR INTERACTIONS. S.N.Biswas.
Proc. Phys. Soc., Vol. 72, Pt 2, 169-81 (Aug., 1958).

As an example of the application of the K-meson production cross-section the K-meson component is considered in the extensive air-showers. A cascade theory of the cosmic-ray shower was developed embracing the fact that the heavy mesons and hyperons cascade in the nucleus in a manner analogous to the pions and nucleons. Numerical results for the nucleons, pions, hyperons and the K-meson components in the longitudinal development of the cosmic-ray air shower were presented and compared with available experimental data. A.

537.591.15

8088. EXPLOSION SHOWERS PRODUCED BY HIGH-ENERGY COSMIC-RAY PARTICLES.
I.I.Gurevich, A.P.Mishakova, B.A.Nikol'skiĭ and L.V.Surkova.
Zh. éksper. teor. Fiz., Vol. 34, No. 2, 265-79 (1958). In Russian.

Experimental results are presented which pertain to 43 shower events induced by 10^{10}-10^{14} eV nucleons and to 20 showers produced by particles with $Z \geq 2$. Asymmetry in the angular distribution of shower particles with respect to the angle $\pi/2$ in the c.m.s. was observed in showers produced by nucleons possessing an energy $>10^{11}$ eV. This fact is not consistent with the concept of shower production on nuclei in nucleon—nucleon collisions or with the predictions of the hydrodynamical theory of multiple production of particles proposed by Belenkiĭ and Landau. A.

537.591.15

8089. ON THE SPATIAL DISTRIBUTION OF PARTICLES IN EXTENSIVE ATMOSPHERIC SHOWERS. G.B.Khristiansen.
Zh. éksper. teor. Fiz., Vol. 34, No. 4, 956-61 (1958). In Russian.

The relative role of various factors affecting the spatial divergence of charged particles in extensive air showers is considered. It is shown that the spatial distribution of electrons is completely determined by Coulomb scattering. The spatial distribution of μ-mesons is to a large degree determined by Coulomb scattering and deflection in the magnetic field of the earth. The transverse momentum transferred to π- and K-mesons in an elementary nuclear cascade act is respectively $\leq 1.5 \times 10^8$ eV/c and $\leq 5 \times 10^8$ eV/c. A.

537.591.15

8090. STRUCTURE OF EXTENSIVE AIR SHOWERS AT SEA LEVEL. A.T.Abrosimov, N.N.Goryunov, V.A.Dmitriev, V.I.Solov'eva, B.A.Khrenov and G.B.Khristiansen.
Zh. éksper. teor. Fiz., Vol. 34, No. 5, 1077-89 (1958). In Russian.

The lateral distribution of electrons, nuclear-active and nuclear-passive particles in extensive air showers containing from 4×10^4 to 4×10^8 particles at sea level was studied with the help of correlated hodoscopes. The experimental data indicate that high-energy nuclear-active particles which determine the development of the shower exist in extensive air showers in the lower layers of the atmosphere. The energy flux of the shower is concentrated in a small radius of the order of several metres from the axis of the shower. A.

537.591.15

8091. ENERGY SPECTRUM OF NUCLEAR ACTIVE PARTICLES IN EXTENSIVE AIR SHOWERS.
O.I.Dovzhenko, O.A.Kozhevnikov, S.I.Nikol'skiĭ and I.V.Rakobol'skaya.
Zh. éksper. teor. Fiz., Vol. 34, No. 6, 1637-8 (1958). In Russian.

The integral energy spectrum in the 10-50 BeV region was found to be of the form E^{-k}, where $k = 0.95 \pm 0.25$ using a multi-plate cloud chamber. W.O.Lock

537.591.3

8092. THE CONVERSION EFFECT OF COSMIC-RAY NEUTRONS AT THE AIR–WATER INTERFACE. E.Bagge and S.Skorka.
Z. Phys., Vol. 152, No. 1, 34-48 (1958). In German.

The neutron intensity was measured by three BF_3 counters (92% enrichment and 1.5 cm diameter), at depths between 0 and 140 cm, in a fresh-water lake situated at sea level. At a depth of 4.6 ± 0.3 cm, a maximum intensity of thermal neutrons (five times that at the lake's surface) was observed. Below 50 cm the conversion effect was found to be unimportant and the neutron flux died away exponentially. A Ra–Be source was used to examine the relationship between the depth of the maximum intensity and the spectrum of the incident neutrons. D.H.Lord

537.591.5 : 523.74

8093. POSSIBILITY OF FORECASTING SOLAR PHENOMENA AND THEIR EFFECTS AT THE EARTH BY THE STUDY OF COSMIC-RAY INTENSITY. J.P.Legrand.
C.R. Acad. Sci. (Paris), Vol. 247, No. 1, 70-3 (July 7, 1958).
In French.

Some evidence is given, that solar chromospheric eruptions, which are followed by geomagnetic and ionospheric disturbances, and a decrease in cosmic-ray intensity, are also preceded, 24-48 hours earlier, by a 1-3% decrease in cosmic-ray intensity. P.Rothwell

537.591.5

8094. A COSMIC RAY INCREASE RELATED TO SOLAR ACTIVITY. J.Katzman.
Canad. J. Phys., Vol. 36, No. 7, 807-14 (July, 1958).

An increase in the intensity of cosmic-ray particles of minimum momentum at Ottawa, Canada, of 4.5×10^9 eV/c was observed with telescopes of solid angles 11.5×10^{-4} and 26.0×10^{-4} sterad. A large increase in cosmic-ray activity for the period September 1956 to February 1957 was observed to accompany a large and sustained increase in solar activity as determined by means of the critical frequency of the F2 layer. A.

537.591.5

8095. THE VARIATION OF SEA LEVEL COSMIC RAY INTENSITY BETWEEN 1954 AND 1957.
A.G.Fenton, K.B.Fenton and D.C.Rose.
Canad. J. Phys., Vol. 36, No. 7, 824-39 (July, 1958).

Results from neutron monitors and meson telescopes at Ottawa (geomagnetic latitude 57°N.) and Resolute (geomagnetic latitude 83°N.) are presented for the years 1954-57, a period of increasing solar activity. The results indicate that the sea level meson intensity at these latitudes decreased by 5-6% between April 1954 and December 1957. During the same period the intensity of the nucleonic component at these stations decreased by over 22%. Investigation of the relative response of the two types of recorder to transient decreases during this period indicates that the long term change in the intensity level cannot be explained completely as an accumulation of shorter transient decreases, which become more frequent at times of high solar activity. It is concluded that the transient decreases are superimposed upon the longer term changes, each being produced by a separate modulation process but ultimately controlled by the general level of solar activity. Significant differences are found in the shape of transient decreases observed at the Canadian stations, both between different components at the one station and the same component at different stations. These may be interpreted as due to a varying energy dependence from one transient decrease to another, and to anisotropy in the primary cosmic radiation at these times. A.

537.591.5

8096. LATITUDE VARIATION OF 27-DAY COSMIC RAY INTENSITY DECREASES. R.R.Brown.
Nuovo Cimento, Vol. 9, No. 2, 197-207 (July 16, 1958).

The latitude variation of cosmic-ray intensity decreases due to the modulation effects of a geocentric nebula of disordered magnetic fields is calculated. Experimental data provided by neutron monitor observations during a period of intense solar activity, when compared with the results of these calculations, show that equatorial variations exceed those given by the modulation mechanism by a factor of two or more. A.

537.591.5

8097. HEMISPHERICAL DISTRIBUTION OF COSMIC RAYS AT 25° GEOMAGNETIC LATITUDE. P.S.Gill and A.N.Mitra.
Nuovo Cimento, Vol. 9, No. 3, 400-11 (Aug. 1, 1958).

A complete investigation has been made of the angular distribution (over various zeniths and azimuths) of the hard component of cosmic rays at the Gulmarg High Altitude Research Observatory (geomagnetic latitude 24.7°N). The azimuth distribution is found to agree closely with an energy law $E^{-1.80}$ dE for all the zenith angles. The zenithal distribution is found to be a cosine power law in which the index "n" varies regularly with azimuth. A sinusoidal dependence of "n" on azimuth has also been obtained by the method of least squares. A.

537.591.5

8098. COSMIC RAYS IN THE EARTH'S MAGNETIC FIELD. P.Rothwell.
Phil. Mag. (Eighth Ser.), Vol. 2, 961-70 (Sept., 1958).

It is shown that the values of cosmic ray cut-off momenta in the earth's magnetic field, observed at many different places, are generally close to the values calculated from Störmer's theory for the motion of charged particles in a dipole field, if the usual centre dipole of the earth is replaced in the Störmer equation by a dipole whose magnitude and direction are determined by the surface field at the place considered. Am empirical expression for the actual cut-off momenta (in terms of the centre-dipole field, and the "surface field" cut-off momenta) is deduced from the variation in sea-level nucleon intensity between London and Cape Town, and gives good agreement with experimental results over a wide range of latitudes and longitudes. It is concluded that discrepancies between centre dipole predictions and experimental observations of cosmic ray intensities and cut-off momenta are due to differences between the earth's real field and the dipole approximation to it, rather than to distortion of the earth's outer magnetic field by ionized interplanetary matter. A.

537.591.5

8099. NATURE OF THE CURRENT REDUCTION IN THE PRIMARY COSMIC RAY INTENSITY.
M.A.Pomerantz, S.P.Agarwal and V.R.Potnis.
Phys. Rev. Letters, Vol. 1, No. 2, 65-8 (July 15, 1958).

The variation of cosmic-ray intensity with altitude was measured at geomagnetic latitudes 52° N and 48° N (in 1958) and comparison is made with the intensity–altitude curves obtained at latitudes 52° N and 69° N in 1949-50. The results are consistent with the hypothesis that only the lowest energy particles, close to the geomagnetic cut-off are prevented from entering the earth's atmosphere at present. P.Rothwell

537.591.5 : 523.75

8100. COSMIC-RAY INCREASES PRODUCED BY SMALL SOLAR FLARES. J.J.Corrigan, S.F.Singer and M.J.Swetnick.
Phys. Rev. Letters, Vol. 1, No. 3, 104-5 (Aug. 1, 1958).

Two very short-lived increases of low-energy cosmic-rays were observed on 9 August 1957 with a specially designed detector of very large sensitive area and short resolving time, operated from an aircraft at 25 000 ft in geomagnetic latitude 55° N. The events lasted for three, and two minutes respectively, each giving a percentage increase of intensity (from normal level) of ~ 30%. They appeared to be associated with a solar flare of importance 1 that occurred on the W limb ~ 20 minutes before the first cosmic-ray event. This is the first experimental evidence of the association of low-energy cosmic-ray particles with small solar flares to be reported. D.R.Barber

537.591.5 : 550.385

8101. THE MAGNETIC STORM EFFECTS AND THE INTERPLANETARY ELECTROMAGNETIC STATE. D.Venkatesan.
Tellus, Vol. 9, No. 2, 209-19 (May, 1957).

The electric field of the beam of rarified, ionized gas ejected from the sun was invoked by Alfvén in connection with geomagnetic storms and aurorae. An attempt is made to study the effects of this electric field on cosmic rays. From a study of the ionization chamber records published by Carnegie Institution for the years 1945 and 1946, it appears that the deceleration in the electric field seems to be the most important among the types of effect expected in cosmic rays. The study reveals that it is possible to use the same mechanism to explain both the 27-day variation and the Forbush decreases. The maximum (or minimum) of cosmic-ray intens

ty precedes the maximum (or minimum) of Kp by 4-6 days. The direction of the electric field of the beam is also discussed. A.

537.591.5

8102. LATITUDE EFFECT OF THE NUCLEON AND MESON COMPONENTS OF COSMIC-RAYS AT SEA LEVEL IN THE INDIAN AND ATLANTIC OCEANS. S.Skorka.
Z. Phys., Vol. 151, No. 5, 630-45 (1958). In German.

Describes observations made during a voyage from Europe to Australia and back. The results agree well with the concept of an eccentric earth dipole magnetic field and with previous measurements of Rose et al.(Abstr. 8854/1956). The magnitude of the latitude variation was 1.78 (Atlantic) and 1.99 (Indian) for the nucleon component, and 1.13 (Atlantic) and 1.16 (Indian) for the meson component. J.M.Hough

537.591.8

8103. ON THE ANALYSIS OF THE SLOW PARTICLES EMITTED FROM COSMIC-RAY STARS. II.
S.Nakagawa, E.Tamai, H.Huzita and K.Okudaira.
J. Phys. Soc. Japan, Vol. 12, No. 7, 747-52 (July, 1957).

For Pt I see Abstr. 3814 (1956). Observations were made on the heavy fragments from stars produced by cosmic-rays and 6.2 BeV protons from bevatrons. The charges of the heavy fragments were determined by measuring the width of tracks. The charge distribution of the heavy fragments emitted from silver or bromine nuclei seems approximately to decrease exponentially. The energy distributions of lithium and beryllium nearly agreed with the curves deduced from the evaporation model, assuming the appropriate nuclear temperatures and Coulomb barrier heights. The angular distributions of them were nearly isotropic. According to these results, the process of slow fragment emission seems to be interpreted as that of evaporation. A.

537.591.8

8104. STUDY OF HIGH-ENERGY NUCLEAR-ACTIVE PARTICLES WITH AN IONIZATION CHAMBER.
G.T.Zatsepin, V.V.Krugovykh, E.A.Murzina and S.I.Nikol'skiĭ.
Zh. éksper. teor. Fiz., Vol. 34, No. 2, 298-300 (1958). In Russian.

Nuclear-active particles possessing energies above 10^{11} eV were studied at an altitude of 3860 m above sea level by means of ionization chambers placed under absorbers of various thicknesses and of a counter hodoscope. Integral spectra of ionization bursts in the chambers are presented and conclusions are drawn regarding the absorption mean free path in air and in lead of nuclear-active particles with energies $> 10^{11}$ eV. A.

MAGNETISM

538.08 : 621.317.44

8105. A MAGNETICALLY SCREENED MEASURING CHAMBER USING MAGNETICALLY BIASED TRANSFORMER-SHEET.
W.Albach and G.A.Voss.
Z. angew. Phys., Vol. 9, No. 3, 111-15 (March, 1957). In German.

This consists of three concentric cylinders with diameters of 20, 190 and 300 cm, and thicknesses of 3.15, 1.0 and 0.5 mm. The length of each cylinder is equal to its diameter. The available screened space is ~ 1 m^3. The cylinders are constructed of transformer-core sheet, and are provided with toroidal magnetizing windings energized with 50 c/s a.c. The screening factor is ~ 100. For providing known fields in the chamber, Helmholtz coils 0.8 m diameter can be inserted. C.F.Pizzey

538.113

8106. PARAMAGNETIC SUSCEPTIBILITY OF CONDUCTION ELECTRONS. T.Tietz.
Z. chem. Phys., Vol. 28, No. 6, 1261-2 (June, 1958).

An effective number of free electrons is calculated for a series of metals on the basis of the Fermi—Thomas method, and applied to a calculation of the susceptibility, in reasonable agreement with experiment for the alkali metals. E.P.Wohlfarth

538.114

8107. THE REVERSIBLE SUSCEPTIBILITY TENSOR OF THE STONER—WOHLFARTH MODEL.
A.Aharoni, E.H.Frei, S.Shtrikman and D.Treves.
Bull. Res. Coun. Israel, Vol. 6A, No. 3-4, 215-38 (April-July, 1957).

The reversible susceptibilities as a function of applied field are calculated both for the direction of the field and for a direction perpendicular to the field. The theory is based on the model used by Stoner and Wohlfarth (Abstr. 681/1948) to calculate the magnetization curve. This assumes an assembly of particles, each of which has a uni-axial anisotropy energy. The case of the positive anisotropy coefficient is discussed in detail, and theoretical results for single particles and for the assembly are given. The irreversible parallel susceptibility is calculated for the same model. The case of negative anisotropy coefficient is briefly discussed. Certain features that are common also to cubic anisotropy are considered. The available experimental data are considered, and preliminary results of experiments given. A.

538.114 : 536.7

8108. ON THE THERMODYNAMICS OF THE FERROMAGNETIC STATE AT LOW TEMPERATURES.
M.I.Kaganov and V.M.Tsukernik.
Fiz. Metallov i Metallovedenie, Vol. 5, No. 3, 561-3 (1957). In Russian.

A low temperatures the specific heat of a metal is given by $C = \alpha T^3 + \beta T + C_S$ where C_S is the spin heat capacity. With large applied fields, $C_S \sim \exp(-\mu H/kT)$; with small H, $C_S \sim T^{3/2}$. Search of the literature leaves it uncertain whether C_S has been observed in either of these cases. A.F.Brown

538.114

8109. ORIGIN OF THE MAGNETIC ANISOTROPY ENERGY OF ANTIFERROMAGNETIC Cr_2O_3. M.Tachiki and T.Nagamiya.
J. Phys. Soc. Japan, Vol. 13, No. 5, 452-5 (May, 1958).

The magnetic anisotropy constant of Cr_2O_3 arising from the dipolar interactions among the chromic ions is calculated to be -0.059 cm^{-1} per ion at absolute zero, and the magnetic anisotropy constant due to the crystalline field combined with the spin—orbit coupling is estimated from the fine-structure coupling constant of ruby and compared with that deduced from the antiferromagnetic resonance experiment by Dayhoff. The value from ruby is too large. The temperature dependence of the anisotropy constant and that of the antiferromagnetic resonance frequency at zero field are discussed. A.

538.114

8110. PROBLEM OF SPIN ARRANGEMENTS IN MnO AND SIMILAR ANTIFERROMAGNETS. F.Keffer and W.O'Sullivan.
Phys. Rev., Vol. 108, No. 3, 637-44 (Nov. 1, 1957).

The magnetic dipolar energy is computed for ordering of the second kind with the four antiferromagnetic sublattices of a face-centred cube making arbitrary spin directions with respect to one another, and this energy is shown to be of the same form in the sublattice direction cosines as is the calculated powder neutron-diffraction pattern. (The dipolar energy is also calculated for ordering of the third kind and shown to lead to a spin arrangement in disagreement with powder neutron-diffraction results on β MnS). The observed neutron patterns in MnO and α MnS agree with minimum dipolar energy, but many spin arrangements can satisfy this and the spins are constrained only to certain regions. Other sources of anisotropy in Mn^{++} salts are shown to be much weaker. A model is introduced in which the spins are constrained by dipolar and exchange forces to point parallel to (111) planes and constrained by the weaker anisotropy to a threefold set of easy axes within these planes. Nagamiya's small-field approximation for the field dependence of the powder susceptibility of a uniaxial antiferromagnet is extended to all values of the applied field, and a similar calculation is made for the powder susceptibility of the MnO model. Comparison with experimental data indicates that the weak within-plane anisotropy is $\sim 3 \times 10^4$ ergs/cm^3 which is to be contrasted with the theoretical out-of-plane dipolar anisotropy of 10^7 ergs/cm^3. A rough theory of antiferromagnetic resonance for the model seems to explain the partial paramagnetic-like absorption observed below the Néel point. A.

538.114

8111. ON THE THERMODYNAMICAL THEORY OF RESONANCE AND RELAXATION PHENOMENA IN FERROMAGNETICS.
G.V.Skrotskiĭ and V.T.Shmatov.
Zh. éksper. teor. Fiz., Vol. 34, No. 3, 740-5 (1958). In Russian.

The methods of thermodynamics of irreversible processes are applied to derive the variation of magnetization of ferromagnetics with time. The role of spin—lattice relaxation in ferromagnetic resonance is discussed. The equations obtained are compared with the Landau—Lifshits and Bloch equations. A.

538.114 : 539.2

8112. ON THE DEPENDENCE OF COERCIVE FORCE ON THE DENSITY OF DISLOCATIONS. Z.Málek.
Z. angew. Phys., Vol. 9, No. 6, 279-80 (June, 1958). In German.

The theoretical relations derived by Vicena (Abstr. 7511/1956) and Kersten (Abstr. 2402/1957) are compared with recent experimental results. The values calculated from Kersten's formula are two orders of magnitude too great, whilst Vicena's formula gives values slightly too small. A.E.De Barr

538.114 : 539.2

8113. REMARKS ON THE PAPER BY Z.MALEK: "ON THE DEPENDENCE OF COERCIVE FORCE ON THE DENSITY OF DISLOCATIONS". M.Kersten.
Z. angew. Phys., Vol. 9, No. 6, 280-1 (June, 1958). In German.

The different definitions of coercive force used by the author and by Vicena (Abstr. 7511/1956) are pointed out. It is also shown that, with the appropriate choice of the value of the density of dislocation, the author's formula gives results of the correct order, and this choice of dislocation density is defended.

A.E.De Barr

538.114 : 539.2

THE PROBLEM OF THE STATISTICS OF SPIN WAVES. See Abstr. 7483

538.22 : 537.323 : 537.311.33

MAGNETIC PROPERTIES OF ZnSb–CdSb. See Abstr. 7962

538.221

8114. CRITERION FOR FERROMAGNETISM FROM OBSERVATIONS OF MAGNETIC ISOTHERMS. A.Arrott.
Phys. Rev., Vol. 108, No. 6, 1394-6 (Dec. 15, 1957).

A criterion is proposed for determining the onset of ferromagnetism in a material as its temperature is lowered from a region in which the linearity of its magnetic moment v. field isotherm gives an indication of paramagnetism. Within the limits of validity of a molecular field treatment, the Curie temperature is shown to be in general indicated by the third power of the magnetization being proportional to the internal magnetic field. The method was employed to redetermine the Curie point of nickel from the data of Weiss and Forrer, of Fe_3O_4 from the data of Smith and of some alloys from the data of Kaufmann and his collaborators and the author. A.

538.221 : 539.12

8115. RADIATION EFFECTS IN MAGNETIC MATERIALS. D.I.Gordon, R.S.Sery and R.E.Fischell.
Nucleonics, Vol. 16, No. 6, 73-7 (June, 1958).

Seven different toroidal cores wound using radiation resistant insulators were exposed to an integrated fast flux of 10^{17} n/cm^2. Magnetic properties measured during irradiation included permeability, coercive force and magnetization curves at 60 and 400 c/s. Measurements of loss factor and magnetostriction were made before and after irradiation. The effects observed are due to changes in the degree of ordering in the samples. The largest changes were shown by 5-79 molybdenum permalloy, and its use as a fast neutron dosimeter is suggested. R.D.Smith

538.221

8116. THE EFFECT OF NON-MAGNETIC INCLUSIONS IN SOFT MAGNETIC MATERIALS. F.Lihl.
Acta phys. Austriaca, Vol. 11, No. 2, 232-40 (1957). In German.

The effects of non-magnetic inclusions on the properties of soft magnetic materials are discussed with reference to the theories of Néel and to experimental results on silicon-iron. Particles in the size range 0.05-1 μ are most harmful and the possibilities of removing such particles or preventing their formation by special annealing treatments are considered. A.E.De Barr

538.221

8117. ON THE OBSERVATION OF WEISS DOMAINS IN POLYCRYSTALLINE MATERIAL THROUGH THE INTENSIFIED MAGNETO-OPTICAL KERR ROTATION.
J.Kranz and W.Drechsel.
Z. Phys., Vol. 150, No. 5, 632-9 (1958). In German.

A film of ZnS was evaporated on to a polished ferromagnetic specimen. Interference of the multiply reflected beams, using plane polarized monochromatic light, so increased the Kerr rotation that the domains could be readily observed during magnetization, either visually or photographically. G.F.Lothian.

538.221 : 621.318.2

8118. THE INFLUENCE OF THE TEMPERING PROCEDURE ON THE THERMAL MAGNETIC AGEING OF PERMANENT MAGNETS OF AN ALLOY OF THE MAGNIKO TYPE.
A.M.Morozova and F.I.Feĭgina.
Fiz. Metallov i Metallovedenie, Vol. 5, No. 3, 428-33 (1957). In Russian.

Heat treatment schedules are derived empirically to give maximum magnetic stability in permanent bar magnets of various sizes composed of an alloy containing Fe + 15% Ni + 24% Co + 8.5% Al + 3% Cu. A.F.Brown

538.221 : 621.318.2

8119. PERFORMANCE OF PERMANENT MAGNETS AT ELEVATED TEMPERATURES. W.H.Roberts.
J. appl. Phys., Vol. 29, No. 3, 405-7 (March, 1958).

The objective of this investigation was to determine the effect of temperature up to 600°C and vibration on the performance of Alnico V and Alnico VI magnets. Data are presented on the effect of cycling stability, coefficient of remanence, extended exposure to elevated temperature and vibration. The results of this investigation show that the use of Alnico V and Alnico VI in most instrument and control applications is feasible up to 500°C. However, a considerable loss in properties should be expected if the temperature exceeds 500°C. A.

538.221

8120. MAGNETIC SUSCEPTIBILITY OF IRON–NICKEL ALLOYS IN LIQUID AND SOLID STATES. Y.Nakagawa.
J. Phys. Soc. Japan, Vol. 12, No. 6, 700-7 (June, 1957).

The magnetic susceptibilities of various Fe–Ni alloys were measured through their melting points up to 1600°C. The susceptibilities of the alloys with less than 60% Ni increase discontinuously on melting, while those of the alloys with more than 60% Ni decrease. The temperature variation of the susceptibilities is approximately expressed by the Curie–Weiss law in the liquid state as well as in the solid state, but the Curie constants and the paramagnetic Curie temperatures of liquids are in general different from those of solids. These results can be explained by assuming that the atomic magnetic moments remain unaltered and that the magnetic interaction varies with the interatomic distance as indicated by the Bethe–Slater curve. The change of susceptibility at the melting point is solely due to the difference in interatomic distance between the liquid and the solid. It is expected, in some cases, that the especially strong dependence of the magnetic interaction on the interatomic distance results in an appreciable change of interaction with temperature through thermal expansion. It can account for the anomalously large Curie constants of pure γ-Fe and Fe-rich alloys in the solid state. A.

538.221

8121. THE MAGNETIC PROPERTIES OF SINGLE CRYSTALS OF Fe–Al ALLOYS IN THE SUPERLATTICE RANGE Fe_3Al.
H.Gengnagel.
Naturwissenschaften, Vol. 44, No. 24, 630 (1957). In German.

The anisotropy constant K_1 for ordered alloys changes sign at about 12% (weight) Al, while for disordered alloys K_1 decreases gradually to vanish at 16% Al. E.P.Wohlfarth

538.221

8122. THE MAGNETIC PROPERTIES OF Fe–Al ALLOY SINGLE CRYSTALS IN THE SUPERLATTICE RANGE. II. MAGNETOSTRICTION AND RESISTIVITY. H.Gengnagel.
Naturwissenschaften, Vol. 45, No. 4, 81-2 (1958). In German.

For Pt I see preceding abstract. Reports results of measurements of the principal magnetostriction coefficients for ordered and disordered alloys; the mean value for an isotropic distribution is deduced. The resistivity of the ordered alloys has a minimum at the composition Fe_3Al. E.P.Wohlfarth

538.221

8123. SOME MAGNETIC PROPERTIES OF DILUTE FERROMAGNETIC ALLOYS. II.
B.W.Lothian, A.C.Robinson and W.Sucksmith.
Phil. Mag. (Eighth Ser.), Vol. 3, 999-1012 (Sept., 1958).

Previous experiments (Pt I, Abstr. 6297/1955) were carried out on the magnetic properties of precipitates of dilute ferromagnetic alloys magnetic properties of precipitates of dilute ferromagnetic alloys precipitated from solid solution in a non-ferromagnetic matrix. This process could be followed from the initial stages of superparamagnetism through single to multi-domain size of the aggregates, and the magnetic measurements correlated with particle growth. In the present communication, the work is extended to the production of precipitates with greater departure from spherical shape produced by cold drawing of suitable alloys of the ferromagnetics iron, nickel and cobalt. Magnetic measurements on the anisotropic specimens so produced are shown to give evidence for the distribution of particle shape, size and structure. The reverse magnetic field required to reduce the remanence to zero is shown to be an additional useful parameter in these determinations. A

538.221

8124. MAGNETIC MATERIALS WITH THE PERMINVAR EFFECT. . CONTRIBUTION TO THE UNDERSTANDING OF THE PERMINVAR EFFECT AND ITS TEMPERATURE DEPENDENCE. A.v.Kienlin. Z. angew. Phys., Vol. 9, No. 10, 520-6 (Oct., 1957). In German.

The Perminvar effect is described and its connection with the uniaxial anisotropy observed by Kaya (Abstr. 8530/1953) in a perm-alloy crystal is discussed. Existing theories of the effect based on a degree of uniaxial anisotropy are reviewed and a qualitative explanation of the temperature dependence of the anisotropy for these theories is suggested. A.J.Manuel

538.221

8125. MAGNETIC MATERIALS WITH THE PERMINVAR EFFECT. I. THE IMPORTANCE OF COMPOSITION, IN FERRITES WITH SMALL COBALT CONTENT, FOR THE PERMINVAR EFFECT. A.v.Kienlin. Z. angew. Phys., Vol. 9, No. 12, 631-40 (Dec., 1957). In German.

The effects on the initial permeability and the hysteresis loops of an iron-rich nickel ferrite and of magnetite, caused by adding small amounts of cobalt were studied at temperatures between -200°C and 100°C. The initial permeability—temperature curves show maxima which occur at higher temperatures for greater cobalt content. The results for magnetite are in qualitative agreement with those of Bickford et al. (Abstr. 8906/1955). For specimens of nickel and slowly cooled magnetite, constricted hysteresis loops of the Perminvar type were observed above the temperature of the initial permeability maxima. Hysteresis loops for quenched and slowly cooled magnetite specimens, for temperatures between -100°C and 25°C, and for applied field amplitudes up to about 4 Oe, are given. The results are interpreted as arising from a change in the sign of the anisotropy constant K_1, at a temperature which increases with increasing cobalt content. A.J.Manuel

538.221 : 621.395.625.3

8126. MAGNETIC WRITING ON THIN FILMS OF MnBi. E.J.Williams, R.C.Sherwood, F.G.Foster and E.M.Kelley. J. appl. Phys., Vol. 28, No. 10, 1181-4 (Oct., 1957).

A study was made of the domain structure of thin films (~ 1000 A) of MnBi and their capability of storing information magnetically. It is estimated that a million bits of information could be written on 1 cm^2 of film. The information can be read out optically by utilizing the Faraday effect. The films have a uniaxial direction of easy magnetization normal to their surfaces and retain their magnetization after saturation along this direction in spite of the large demagnetizing factor. When magnetized in this manner, a high optical contrast is obtained between the writing and the background. A.

538.221

8127. DISPERSION OF THE COMPLEX TRANSVERSE SUSCEPTIBILITY OF LITHIUM FERRITE IN THE FREQUENCY RANGE 10-10000 Mc/s. F.Voigt. Ann. Phys. (Leipzig), Folge 7, Vol. 1, No. 1-3, 86-101 (1958). In German.

Measurements of the real and imaginary parts of the complex magnetic susceptibility in tranverse static fields up to 8000 Oe were made on thin annular discs of lithium ferrite. From supplementary measurements of the initial magnetization curve and the demagnetizing factors of the specimens the internal transverse field was calculated as a function of the applied field. The magnetic spectra for 11 values of internal field up to 1490 Oe show two dispersion regions at about 50 Mc/s and 2500 Mc/s. From the variation of the shape of the curves it is deduced that the dispersion region near 50 Mc/s arises from rotational processes. A.J.Manuel

538.221 : 621.318.12

8128. ROTATIONAL MODEL OF FLUX REVERSAL IN SQUARE LOOP FERRITES. E.M.Gyorgy. J. appl. Phys., Vol. 28, No. 9, 1011-15 (Sept., 1957).

A brief review of the experimentally established details of the flux reversal process in square loop ferrites is given. The discrepancies between the experimental results and the predictions of the domain wall motion theory are discussed. The switching coefficient S_w is examined in detail. The rotational model is based on the solution of the modified Landau and Lifshitz equation and predicts the shape of the output voltage pulse, the relationship between the flux reversal time and the applied field, and the minimum switching coefficient that can be obtained for a given ferrite. The switching coefficients determined experimentally are within a factor of three of the minimum value of S_w predicted by this model. A.

538.221

8129. MAGNETIC PROPERTIES OF PEROVSKITES CONTAINING STRONTIUM. I. STRONTIUM-RICH FERRITES AND COBALTITES. H.Watanabe. J. Phys. Soc. Japan, Vol. 12, No. 5, 515-22 (May, 1957).

Magnetic susceptibilities and electrical conductivities of (La, Sr)(Fe/Co)O_x samples sintered in vacuo or in an oxygen stream were measured. Samples containing tetravalent magnetic ions in general have Curie contants smaller than those containing only trivalent ions. This fact and the high conductivity in the former specimens strongly support the combined effect of the double exchange and the usual exchange mechanism in these compounds. The parallel alignment of spins of magnetic ions due to double exchange is partly or completely hindered by the presence of the strongly negative trivalent—trivalent interionic interactions. A.

538.221 : 621.318.12

8130. TEMPERATURE DEPENDENCE OF SPONTANEOUS MAGNETIZATION IN Co—Zn FERRITES AT LOW TEMPERATURES. N.M.Reĭnov and M.F.Smel'makh. Radiotekhnika i Elektronika, Vol. 2, No. 3, 342-4 (1957). In Russian.

The results are given of an experimental investigation of dependence of saturation magnetization of Co—Zn ferrites on temperature from the Curie point to 1.3°K. It is shown that for these materials the expected decrease (Vonsovskiĭ—Agafonova theory) of saturation magnetization was not observed down to 1.3°K. W.Bezdel

538.222

8131. ATTEMPT TO INTERPRET THE SHAPE OF PARAMAGNETIC RESONANCE SIGNALS BY THE INTRODUCTION OF THE HIGH-FREQUENCY DEMAGNETIZING FIELD. A.Charru. C.R. Acad. Sci. (Paris), Vol. 246, No. 25, 3445-7 (June 23, 1958). In French.

The effect on the paramagnetic resonance absorption line shape when the high-frequency field is corrected for the demagnetizing effect of the specimen is considered for narrow lines. Good agreement is obtained between calculated and observed line-shapes for diphenyl-picryl hydrazyl at 3000 Mc/s. A.J.Manuel

538.222

8132. EXPERIMENTAL ARRANGEMENTS FOR THE MEASUREMENT OF PARAMAGNETIC RELAXATION AND RESONANCE, AND OF MAGNETIC NUCLEAR RESONANCE IN THE LOUVAIN LABORATORY. II. PARAMAGNETIC ELECTRON RESONANCE IN WEAK MAGNETIC FIELDS. L.van Gerven, A.van Itterbeek and E.de Wolf. Meded. K. Vlaamse. Acad. Wetensch., Vol. 19, No. 6, 43 pp. (1957). In Dutch.

For Pt I, see Abstr. 3449 (1957). In a theoretical introduction the theory of Bloch is briefly explained, and some modifications, which have to be applied to this theory in the case of weak steady magnetic fields, are mentioned. An apparatus for paramagnetic electron resonance in weak fields is described in detail. This apparatus was constructed in order to study accurately narrow electron resonance lines, and especially to measure line shapes, Landé-factors and line-widths. Special precautions were taken in designing and constructing the apparatus, which is also suitable for the study of magnetic nuclear resonance. The methods for the accurate calibration of the steady and the sweeping field, and for the different measurements are described. The corrections to Bloch's theory have been calculated numerically and are given in the form of graphs. A.

538.222

8133. PARAMAGNETIC RESONANCE OF NEW ORGANIC RADICALS. A.K.Chirkov and R.O.Matevosyan. Zh. éksper. teor. Fiz., Vol. 33, No. 4(10), 1053-4 (1957). In Russian. English translation in: Soviet Physics — JETP (New York), Vol. 6, No. 4, 811-12 (April, 1958).

Paramagnetic resonance measurements were made on $\alpha\alpha$-diphenyl β-picryl hydrazyl with halogens and OCH_3 substituted in the para-position of the α-phenyl ring. A progressive change of χ'', line width, and ratio of fourth to second moment of the line shape was observed on going through the series from H to F. J.M.Baker

538.222 : 537.312.62

MAGNETIC BEHAVIOUR OF Nb_3Sn IN THE SUPERCONDUCTING TRANSITION REGION. See Abstr. 7984

538.224

8134. ON THE DIAMAGNETIC ANISOTROPY OF BENZENE. P.G.Lykos and R.G.Parr.

J. chem. Phys., Vol. 28, No. 2, 361 (Feb., 1958).

Most of the discrepancy between the calculated and observed values of the diamagnetic anisotropy of benzene can be accounted for by the inclusion of certain enhancement factors in the calculation. G.I.W.Llewelyn

538.23

8135. THE EFFECT OF TEMPERATURE ON THE "CREEPING" [REPTATION] OF ASYMMETRICAL HYSTERESIS CYCLES.
Nguyen Van Dang.
C.R. Acad. Sci. (Paris), Vol. 247, No. 1, 56-9 (July 7, 1958). In French.

A continuation of previous work (see Abstr. 6055-6/1958). Reports results of experiments between 20°K and room temperature, and finds that the temperature changes have no very marked effects on the phenomenon which, it is concluded, has origins different from those responsible for magnetic viscosity. E.P.Wohlfarth

538.23 : 538.245

8136. HYSTERESIS LOOPS ASSOCIATED WITH A SIMPLE DOMAIN STRUCTURE. A.Hart.
Proc. Phys. Soc., Vol. 72, Pt 2, 244-8 (Aug., 1958).

The complex domain structures existing in most ferromagnetic specimens prevent precise information about individual domain processes from being obtained from technical magnetization curves. Experiments on ring specimens of a magnetically annealed Perminvar-type alloy show that reversal of magnetization in such specimens involves only one 180° domain wall. Rings of varying external to internal diameter ratio were used, and the hysteresis loops of all specimens could be explained using a simple theoretical model. All specimens except those whose hysteresis loops were controlled by nucleation processes had the same coercive field, 0.09 oersted. This field gave a direct measure of the impedance to motion of an isolated 180° wall. The experiments also show that the use of a specimen with large external to internal diameter ratio effectively reduces the slope of the sides of the measured (B, H) loop; a close approach to a rectangular loop is possible only in specimens with small radial width. The effects of nucleation are evident in all of the loops, and in the case of the specimens with the smallest radial width, the loop shapes are controlled entirely by nucleation. A.

538.23

8137. NEW TECHNIQUE FOR MEASURING ROTATIONAL HYSTERESIS IN FERROMAGNETIC MATERIALS. J.M.Kelly, Jr.
Rev. sci. Instrum., Vol. 28, No. 12, 1038-40 (Dec., 1957).

A new experimental technique for measuring rotational hysteresis losses over the frequency range from 3 to 30 c/s is described. A sample disk of ferromagnetic material is mounted on a top. The top is caused to spin about a vertical axis normal to the plane of the disk and of the magnetic field provided by an electromagnet. After removal of the driving force, the top dissipates its stored energy in losses in the sample and in bearing and windage losses. The bearing and windage losses are obtained by also performing the experiment in a magnetic field-free region. The rate of change of rotational energy of the top is determined by measuring the angular velocity of the top as a function of time. A.

538.23

8138. CONTRIBUTION TO THE EXPLANATION OF MAGNETIC AFTER-EFFECT THROUGH ELECTRON DIFFUSION IN FERRITES. A.v.Kienlin.
Z. angew. Phys., Vol. 9, No. 5, 245-50 (May, 1957). In German.

The results are reported on measurements on specimens of a nickel-zinc ferrite, sintered in oxygen and in air at temperatures between 1200°C and 1350°C. The electrical resistivity and the ratio of remanent to saturation magnetization decrease as the sintering temperature is increased. The variation of loss angle with temperature shows a maximum whose amplitude increases and moves to a lower temperature, as the sintering temperature is increased. On the assumption that the losses are due to magnetic after-effect, activation energies are deduced for electron diffusion from experiments at frequencies between 2 kc/s and 100 kc/s, and temperatures from −150°C to 100°C. A qualitative interpretation of the results is given by assuming that stabilization of the direction of spontaneous magnetization arises from an anisotropic distribution of a small concentration of Fe^{2+} ions and misplaced oxygen atoms, and that magnetic after-effect results from electron exchange between Fe^{2+} ions and Fe^{3+} ions when the direction of magnetization is changed. A.J.Manuel

538.242

8139. THE PRESSURE DEPENDENCE OF THE FERROMAGNETIC ANISOTROPY ENERGY. D.Gugan and G.Rowlands.
Proc. Phys. Soc., Vol. 72, Pt 2, 207-13 (Aug., 1958).

A formula is derived and used to analyse measurements of the change of technical magnetization caused by the application of hydrostatic pressure. Some of the changes can be described by a dependence of the ferromagnetic anisotropy energy on pressure. Values are obtained for this pressure dependence in certain nickel–iron alloys and they are found to agree moderately well with estimates made from volume magnetostriction measurements. A.

538.245

8140. MAGNETIZATION PROCESSES IN A POLYCRYSTALLINE MANGANESE ZINC FERRITE.
L.F.Bates, H.Clow, D.J.Craik and P.M.Griffiths.
Proc. Phys. Soc., Vol. 72, Pt 2, 224-32 (Aug., 1958).

A description is given of Bitter figure, magneto-thermal and Barkhausen studies of the behaviour of a polycrystalline manganese zinc ferrite during magnetization, from which it is concluded that the processes of magnetization are entirely rotational. A.

538.245 : 538.613

8141. THE USE OF THE KERR EFFECT FOR STUDYING THE MAGNETIZATION OF A REFLECTING SURFACE.
E.W.Lee, D.R.Callaby and A.C.Lynch.
Proc. Phys. Soc., Vol. 72, Pt 2, 233-43 (Aug., 1958).

If a moving domain wall crosses a small illuminated area, the reflection coefficient may change and the plane of polarization of the reflected light may be rotated. If the wall moves in an alternating field, the change can be detected by collecting the light on a photomultiplier cell and amplifying the alternating component of its output signal. Using a specimen of a magnetically annealed Perminvar-type alloy, the variation of the output signal and of the signal-to-noise ratio with the angle of polarization was shown to agree closely with that predicted by theory, both for longitudinal and transverse magnetizations. It is unnecessary to use both a polarizer and an analyser; indeed, an effect is observable with neither. A.

538.245 : 538.652

8142. MAGNETOSTRICTION CURVES OF POLYCRYSTALLINE FERROMAGNETICS. E.W.Lee.
Proc. Phys. Soc., Vol. 72, Pt 2, 249-58 (Aug., 1958).

An approximate method is given for calculating the magnetostriction of a random polycrystal as a function of the magnetization in the range over which magnetization occurs by rotation of the domain magnetization vectors. Calculations valid for the cases of cubic and hexagonal symmetry (these only for the case in which the easy axis is the hexagonal axis) are given in parametric form. Using these calculations and earlier calculations of Brown (1938) for the range of magnetization where boundary displacements occur it is possible to calculate the magnetostriction as a function of magnetization over the entire range from zero to saturation. A.

538.27 : 538.652 : 534.232 : 621.318.12

8143. EFFECT OF DIVALENT ION SUBSTITUTIONS ON THE MAGNETOMECHANICAL PROPERTIES OF NICKEL FERRITE.
S.F.Ferebee and C.M.Davis, Jr.
J. Acoust. Soc. Amer., Vol. 30, No. 8, 747-50 (Aug., 1958).

Magnetostrictive properties of cobalt-substituted nickel ferrous-ferrite were investigated to determine its suitability for use in electromechanical transducers. Toroidal samples were sintered at 1400°C and cooled by quenching in air. The following parameters were measured and compared with the corresponding parameters of previously investigated magnetostrictive materials: electromechanical coupling coefficient, reversible permeability, dynamic magnetostrictive constant, maximum stress, and the product of characteristic frequency times the thickness squared. The results of the investigation indicate that a ferrite having the formula $(NiO)_{1-x-y}(CoO)_x(FeO)_y(Fe_2O_3)$ with $0.015 \leq x \leq 0.04$ and $0.02 \leq y \leq 0.065$ moles per mole of ferrite meets the requirements for transducer applications. The electromechanical coupling coefficient for this range of compositions varies from 0.28 to 0.37. The value of the characteristic frequency times the thickness squared (4200) is approximately 1700 times that of nickel. The maximum stress increases with ferrous iron, reaching a value of 68×10^6 dyn/cm² for 0.06 mole of FeO per mole of ferrite as compared with 32×10^6 dyn/cm² for no ferrous iron. A.

538.27 : 539.2

8144. THEORY OF DE HAAS–VAN ALPHEN EFFECT FOR OPEN ISOENERGY SURFACES. G.E.Zil'berman.
Zh. éksper. teor. Fiz., Vol. 34, No. 1, 243-5 (1958). In Russian.

The de Haas–van Alphen effect concerns the correlation of the collective magnetic susceptibility of an electron assembly with variations in the applied magnetic field. In any such assembly surfaces of constant electronic energy can be defined; when these isoenergy surfaces are plane the situation is analogous to that dealt with in the dispersion theory of crystals and the results of this theory can be applied to the de Haas–van Alphen effect. J.W.Gardner

538.27 : 539.2

BAND STRUCTURE OF GRAPHITE AND DE HAAS–VAN ALPHEN EFFECT. See Abstr. 7489

538.27 : 538.652 : 539.374

PLASTIC DEFORMATION AND MAGNETOSTRICTION. See Abstr. 7565

538.27 : 537.321 : 537.311.3

THERMOMAGNETIC EFFECTS IN ISOTROPIC METALS AND SEMICONDUCTORS. See Abstr. 7897

ELECTROMAGNETISM. ELECTRODYNAMICS

538.3

8145. ON THE INTERPRETATION OF MAXWELL'S EQUATIONS BY MEANS OF ELECTRIC AND MAGNETIC QUANTITIES. H.Hofmann.
Acta phys. Austriaca, Vol. 11, No. 2, 241-51 (1957). In German.

It is shown that by averaging certain microscopic differential equations of electromagnetism, formulated symmetrically in terms of electric and magnetic quantities, one obtains the macroscopic Maxwell equations if the average of the microscopic magnetic field strength is identified with the macroscopic magnetic field strength (and not the induction). P.Roman

538.3 : 530.145

8146. POTENTIAL WELLS FOR CHARGED PARTICLES IN A HIGH-FREQUENCY ELECTROMAGNETIC FIELD. A.V.Gaponov and M.A.Miller.
Zh. éksper. teor. Fiz., Vol. 34, No. 1, 242-3 (1958). In Russian.

It is shown that in a high-frequency field a particle can be localized in a potential well. G.E.Brown

538.3

8147. INTERACTION BETWEEN A MEDIUM AND THE [ELECTRIC] CURRENT ENTERING IT. V.N.Tsytovich.
Zh. éksper. teor. Fiz., Vol. 34, No. 6, 1646-8 (1958). In Russian.

Electrostatic and electromagnetic forces will in general be induced in any current-carrying medium with finite resistivity, and these forces will react back on the current producing them. Expressions are derived for these forces and used to formulate current-stability criteria. J.W.Gardner

538.3 : 532.5

8148. ON CIRCULAR CYLINDRICAL VORTICES IN MAGNETO-HYDRODYNAMICS. T.Zeuli.
Atti Accad. Sci. Torino I, Vol. 92, No. 1, 105-14 (1957-58). In Italian.

Expressions are derived for fluid pressure and velocity, and for the magnetic field intensity, in the case of an axially symmetric vortex of finite radius at rest in a uniform conducting liquid of unlimited extent, the magnetic field being parallel to the axis of the vortex. R.A.Newing

538.3 : 532.5

8149. THE EQUILIBRIUM OF A SELF-GRAVITATING INCOMPRESSIBLE FLUID SPHERE WITH MAGNETIC FIELD. P.L.Bhatnagar.
J. Indian Inst. Sci. A, Vol. 40, No. 2, 50-73 (April, 1958).

The Chandrasekhar–Prendergast description of possible magnetic fields in terms of functions defining toroidal and poloidal fields is expressed in modified form. Particular solutions, obtained for axially symmetric, infinitely conducting liquid configurations, include several cases considered by other authors. R.A.Newing

538.3 : 532.5

8150. HIGHER ORDER INTERACTIONS IN HOMOGENEOUS TURBULENCE THEORY. R.H.Kraichnan.
Phys. of Fluids, Vol. 1, No. 4, 358-9 (July-Aug., 1958).

In an earlier paper (Abstr. 2426/1958) a theory of homogeneous turbulence was developed from the two statistical assumptions of weak-dependence and direct-interaction. Further work is now described which suggests that the second assumption is better termed the direct-interaction approximation. S.Weintroub

538.3 : 532.5

8151. EXPERIMENTAL INVESTIGATION OF THE INHIBITION OF CONVECTION BY A MAGNETIC FIELD. K.Jirlow.
Tellus, Vol. 8, No. 2, 252-3 (May, 1956).

Chandrasekhar's theory (Abstr. 6456/1952) of stability of a layer of conducting fluid, subject to an external magnetic field and heated from below, was experimentally confirmed for mercury, in the range 0-10000 gauss. T.P.Brody

538.3 : 532.5

8152. PLANE PROBLEMS IN MAGNETOHYDRODYNAMICS. G.S.Golitsyn.
Zh. éksper. teor. Fiz., Vol. 34, No. 3, 688-93 (1958). In Russian.

The conditions of possibility of motion in magnetohydrodynamics are deduced and the motion is investigated. The investigations reduce to conventional hydrodynamic problems. The Prandtl–Mayer problem for a conducting gas in a magnetic field and its generalization and applications are studied in detail. A.

538.31

8153. STABLE OSCILLATION OF CONDUCTING BODIES IN THE ALTERNATING MAGNETIC FIELD OF PARALLEL WIRES. A.Mager and R.Brenner.
Z. angew. Phys., Vol. 10, No. 1, 36-41 (Jan., 1958). In German.

Experiments are described in which particles of diamagnetic or superconductive materials were maintained in oscillation in an alternating magnetic field. A theoretical investigation is made of the conditions for stable oscillation of particles in the field of (a) a pair of wires, (b) four wires forming a quad, (c) a grid formed of coplanar parallel wires. V.G.Welsby

538.311

8154. OPEN LINES OF A MAGNETIC FIELD. S.S.Ştefănescu.
Stud. Cercetări Fiz., Vol. 9, No. 1, 7-24 (1958). In Roumanian.

Analyses the H lines determined by 4 rectilinear currents of equal intensity, arranged in pairs in 2 horizontal planes so as to form "complete" angles [4d]; each pair is a vertical projection of the other and the directions of currents in parallel sides are opposite to each other. A system of differential equations for the H lines in relation to an arbitrary point, derived from Biot-Savart's law, proves to be compatible with an algebraical integral of the 8th degree. By using the method of elementary invariant magnetic flux, it is possible to find one of the integrals involved, by equating an Abel integral, related to the surfaces of the algebraical integral, to an arbitrary constant. The author studies in detail the particular case when the angle between both currents is zero and the intensities rise to infinity (the "twin-needle" arrangement). It is shown that the H lines of 2 anti-parallel "twin needles" lie on algebraic cylinders of the 4th degree, and that they can be determined by means of an elliptic integral; they comprise as a rule one closed and one open branch. F.Lachman

538.54 : 537.312.62

MAGNETIC FIELD DEPENDENCE OF HIGH-FREQUENCY PENETRATION INTO A SUPERCONDUCTOR. See Abstr. 7981

ELECTROMAGNETIC WAVES AND OSCILLATORS

538.561 : 537.523.4

8155. PRODUCTION OF MILLIMETER WAVES BY A SPARK GENERATOR. J.Hart.
J. appl. Phys., Vol. 28, No. 4, 743 (April, 1958).

The amount of power radiated from resonating steel dipoles, suspended in insulating oil proved insufficient to be of practical interest, despite the simplicity of the arrangement. A.E.D.Heylen

538.561

8156. EFFECT OF MONOCHROMATIC RADIATIONS ON THE FREQUENCY OF RADIO-FREQUENCY OSCILLATIONS IN A.C. "SILENT" DISCHARGES. P.S.V.Setty and C.M.Srivastava.
J. sci. industr. Res., Vol. 16B, No. 12, 521-3 (Dec., 1957).

The decrease in the wavelength of the r.f. oscillations set up in iodine vapour and hydrogen gas discharge tubes fitted with external "sleeve"-electrodes, when illuminated by different monochromatic radiations in the range 3660-5780 A, was determined. The decrease in the wavelength of the r.f. oscillations, on exposure to different

monochromatic radiations of the same intensity, varies linearly with the frequency of the irradiating light, but increases with increase in the intensity of the radiation, and in some cases, tends to a saturation value. A.

538.561 : 537.533 : 537.534

8157. CIRCULAR WAVES IN AN ELECTRON–ION BEAM.
R.V.Polovin and N.L.Tsintsadze.
Zh. éksper. teor. Fiz., Vol. 34, No. 3, 637-42 (1958). In Russian.

Circular waves are considered in an non-compensated electron–ion beam contained in a cylindrical waveguide with perfectly conducting walls. The magnetic field due to the beam current is assumed to be very large. The investigation is performed by qualitative methods without a rigorous solution of the differential equations. It is shown that the beam is stable with respect to the oscillations under consideration and the intervals which contain the eigenfrequencies were determined. The topography of the electromagnetic field is determined. A.

538.561 : 621.385.1.029.6

8158. APPLICATION OF THE HARMONIC OSCILLATIONS OF ELECTRONS TO THE GENERATION OF VERY HIGH FREQUENCIES.
P.A.Borodovskii.
Zh. tekh. Fiz., Vol. 27, No. 10, 2353-5 (1957). In Russian.

Reports briefly the results of an investigation of an experimental tube in which harmonic oscillations of electrons were used to generate v.h.f. The frequency range obtained is 310 to 600 Mc/s.

538.561 : 539.14

8159. STUDY OF THE DYNAMIC HIGH-FIELD POLARIZATION AND THE CONSTRUCTION OF AN AUTO-OSCILLATOR OF THE MASER TYPE. E.Allais.
C.R. Acad. Sci. (Paris), Vol. 246, No. 14, 2123-6 (April 9, 1958). In French.

It is shown experimentally that a nuclear resonance line can be inverted by interaction with the paramagnetic saturated resonance-levels of a free radical. The free radicals are the ions NO $(SO_3)_2^{--}$ of potassium salt. An aqueous solution is placed in a resonator inside a homogeneous magnetic field of 3300 G and the paramagnetic resonance line is saturated by means of an 8 W microwave magnetron. The oscillation output is at the proton Larmor-frequency and is detected by a Q-meter arrangement. The cavity contains a coil supplied by a low-frequency h.f. generator and the voltage at the coil terminals shows a relative voltage change $\Delta V/V$ corresponding to a change $\Delta Q/Q$ at the Larmor resonance-frequency of the water molecule protons. H.Motz

538.561 : 621.375.9

8160. A MASER WITH PURELY NUCLEAR MAGNETIC RESONANCE. H.Benoit, P.Grivet and L.Guibé.
C.R. Acad. Sci. (Paris), Vol. 246, No. 26, 3608-10 (June 30, 1958). In French.

A current of water is used with protons oriented by means of a resonance arrangement. The water current with a negative spin temperature of about -400°K is passed through a coil tuned to 30 Mc/s connected to a reaction valve, so that the Q of the circuit is, by feedback, increased to about 10 000. A magnetic field is applied, and slowly varied. When the proton resonance frequency is sufficiently near to 30 Mc/s, beats are observed by means of a heterodyne receiver weakly coupled to the coil, indicating that maser type oscillations are present. Possible applications are discussed. H.Motz

538.561 : 539.2

ELECTRON SPIN AND PHONON EQUILIBRIUM IN MASERS.
See Abstr. 7517

538.561

8161. OPERATION OF A SOLID-STATE QUANTUM-MECHANICAL AMPLIFIER.
M.W.P.Strandberg, C.F.Davis, B.W.Faughnan, R.L.Kyhl and G.J.Wolga.
Phys. Rev., Vol. 109, No. 6, 1988-9 (March 15, 1958).

The operation of an S-band solid-state quantum-mechanical amplifier operated at 4.2°K with a computed noise temperature of less than 4.5°K is compared with similar devices and is used as proof of the condition of discrete phonon saturation, which has been previously postulated. A.

538.561 : 621.375.9

8162. ON THE USE OF TWO AUXILIARY FIELDS TO OBTAIN EMISSION STATES IN QUANTUM MECHANICAL AMPLIFIERS AND GENERATORS. V.M.Kontorovich.
Zh. éksper. teor. Fiz., Vol. 33, No. 4(10), 1064-5 (1957). In Russian. English translation in: Soviet Physics — JETP (New York), Vol. 6, No. 4, 820-1 (April, 1958).

It is proposed to use four levels $m > p > n > q$ of a molecular system. By simultaneous application of two fields with frequencies ω_{mn} and ω_{pq} the system may be made to generate or amplify at a frequency ω_{mq} larger than that of either of the auxiliary fields. The two auxiliary fields are applied for a pulse length τ lasting an odd number of periods of both fields and the field strengths are so chosen that the same pulse length corresponds to simultaneous inversion of the population of both pairs of levels. H.Motz

538.566

8163. DIFFRACTION BY A METAL PLATE LENS FOR ARBITRARY INCIDENCE AND POLARIZATION. R.A.Hurd.
Nat. Res. Coun. Canad. Publ., No. 3599, 10 pp. (March, 1955).

Using the residue method of Berz (Abstr. 1950/1951) and Whitehead (Abstr. 1615B/1951; Proc. Instn Elect. Engrs, Pt I, Vol. 98, 133-40, March, 1951 [Reprint No. 1093]), the diffraction problem of a plane wave of arbitrary angle of incidence and arbitrary polarization on a parallel plate lens is solved. Formulae for the reflection coefficients are derived for a number of cases. A.

538.566 : 535.42 : 621.396.677.833.2

PHASE DISTRIBUTION IN THE IMAGE SPACE OF A MICROWAVE LENS. See Abstr. 7848

538.566

8164. BABINET'S PRINCIPLE FOR DIFFRACTION AT A PLANE SCREEN WITH DIRECTIONAL CONDUCTIVITY.
G.Toraldo di Francia.
Nuovo Cimento, Vol. 9, No. 2, 309-15 (July 16, 1958).

A plane and infinite thin screen Σ_1 of any type of connection is a part of a plane $\Sigma_1 + \Sigma_2$. A system of regular lines (lines of conductivity) is defined over Σ_1, such that through each point of Σ_1 there passes one line of the system, and only one. Conductivity is assumed to be infinite along the lines of conductivity, and to vanish along their normals. A general electromagnetic wave is incident upon Σ_1. A complementary case, in the sense of Babinet's principle, is obtained when Σ_1 has still the same properties, while Σ_2 becomes a screen of infinite and omnidirectional conductivity. A.

538.566 : 621.371

8165. RADIATION RESULTING FROM AN IMPULSIVE CURRENT IN A VERTICAL ANTENNA PLACED ON A DIELECTRIC GROUND.
C.L.Pekeris and Z.Alterman.
J. appl. Phys., Vol. 28, No. 11, 1317-23 (Nov., 1957).

The electromagnetic field generated by passing an impulsive current of the form of a delta function $\delta(t)$ through a vertical dipole aerial placed on a dielectric ground is considered. The problem is formulated in operational form, and the Hertzian potential Π is expressed as an integral over a Bessel function. This operational solution is then inverted, and the Hertzian potential $\Pi(r,z,t)$ is expressed in terms of finite complex integrals over a fixed range. The integrals for Π were evaluated on an electronic computer, and the results for the case of a dielectric constant $\epsilon = 9$ are shown. The field in the air starts with a finite value at the time of arrival of the wave front, and then increases in a monotone fashion towards the steady-state value. In the ground, there is a cone of angle $\sin^{-1}(1/\sqrt{\epsilon})$ centred around the downward vertical, inside which the field starts again with a finite value and then decreases toward the steady-state value. Outside this cone, the direct wave in the ground is preceded by a diffracted wave originating from secondary radiation emanating from the portion of the boundary where the air wave passed in advance of the ground wave. This diffracted wave starts with zero amplitude and increases thereafter, becoming logarithmically infinite at the time of arrival of the direct wave in the ground. After that the amplitude decreases continuously toward the steady-state value. A.

538.566 : 621.372.822

8166. FIELDS IN GAP-EXCITED RECTANGULAR DUCTS.
J.Van Bladel.
J. appl. Phys., Vol. 28, No. 12, 1479-83 (Dec., 1957).

The electromagnetic field in a rectangular waveguide, cut in two by a plane perpendicular to its longitudinal axis, is investigated. A voltage applied across the two halves of the guide generates the field structure, which is analysed for several values of the frequency (between zero and cutoff) and of the aspect ratio of the cross-section. The problem is of interest for the design of particle accelerators. A.

538.566 : 621.372.829

8167. PROPAGATION OF WAVES IN HELICAL WAVE GUIDES.
Chiao-Min Chu.

J. appl. Phys., Vol. 29, No. 1, 88-99 (Jan., 1958).

The field configuration near the conductors of a helical waveguide is obtained from the solution of the spatial-wave equation for a developed helix. This solution is first obtained for the case of tape conductors and then adapted to elliptical (including circular) conductors by conformal transformation. By comparing this solution with that of a developed-sheath helix, the impedance, attenuation, and other parameters of a wire helix are deduced approximately. These are expressed as the product of the corresponding sheath-helix parameter times a proper correction factor depending on frequency, conductor size, and shape. The analysis is extended to the multifilar helix. The results of this analysis provide a means of calculating the attenuation of wire helices and of choosing optimum wire configurations in the design of helical waveguides. A.

538.566 : 621.372.822

8168. BEHAVIOR OF THE TE MODES IN FERRITE LOADED RECTANGULAR WAVE GUIDE IN THE REGION OF FERRIMAGNETIC RESONANCE. W.J.Crowe.

J. appl. Phys., Vol. 29, No. 3, 397-8 (March, 1958).

A computation is described which reveals the exact values of the propagation constants of the TE modes in rectangular waveguide loaded with a transversely magnetized ferrite slab over a frequency interval which includes resonance. Magnetic losses are included in the analysis. It is shown that the way in which the modes link through resonance depends upon the value of the magnetic damping parameter, and further that they generally link in such a way that an interference between two or more modes will occur. A.

538.566 : 621.372.823

8169. ENERGY DISTRIBUTION IN PARTIALLY FERRITE-FILLED WAVE GUIDES. J.E.Tompkins.

J. appl. Phys., Vol. 29, No. 3, 399-400 (March, 1958).

The theory of wave propagation in circular waveguides containing coaxial longitudinally-magnetized ferrite rods is examined for cases where the rod diameter is too large for accurate perturbation treatment. Several solutions of the transcendental equation were computed with the aid of experimental data. Field distribution and energy concentration data thus obtained are given for several cases for positive and negative rotating waves. A.

538.566 : 621.372.8

8170. ORTHOGONALITY PROPERTIES FOR MODES IN PASSIVE AND ACTIVE UNIFORM WAVE GUIDES. A.D.Bresler, G.H.Joshi and N.Marcuvitz.

J. appl. Phys., Vol. 29, No. 5, 794-9 (May, 1958).

Orthogonality relations are given for the "four-vector" guided modes of anisotropic uniform waveguides and for the "six-vector" guided modes of uniform waveguides containing unidirectional electron beams with axially independent d.c. velocities. In general, these orthoganality relations involve both the modes of the given waveguide and those of an appropriate "adjoint" waveguide. A description is given for the adjoint waveguides associated with waveguides which contain media whose characteristics are restricted only by the requirement that they be axially independent and which, if bounded, are subject to a variety of boundary conditions arising from idealizations of actual boundaries. A.

538.566 : 621.372

8171. PROPAGATION OF MICROWAVES ON A SINGLE WIRE. I. J. Indian Inst. Sci. B, Vol. 37, No. 3, 200-23 (July, 1955). S.K.Chatterjee and P.Madhavan.

Some quantitative measurements on cylindrical surface waves excited on a cylindrical bare copper conductor were made at 3.2 cm wavelength. The results of radial field measurements indicate fair agreement with results predicted by theory. The decay coefficient for the radial field is 14.0 m^{-1}. It is suggested that the surface conductivity of metals in the form of wire can be found at microwave frequencies by using this method. Field distributions near the launching horn were found to be considerably distorted due probably to the presence of complementary waves. The design and constructional details of the launching system, probe, etc. used in the experiment are presented. A.

538.566 : 621.372

8172. PROPAGATION OF MICROWAVES ON A SINGLE WIRE. II. S.N.Contractor and S.K.Chatterjee.

J. Indian Inst. Sci. B, Vol. 39, No. 1, 52-67 (Jan., 1957).

Expressions for the longitudinal and transverse impedance were derived from the field components of the E_o wave with which the surface wave line is excited. Three different types of termination to match the line were tried. The results of v.s.w.r. measurements with the probe placed in the E_z and E_r orientations at different radial distances from the surface wave line exhibit the superiority of a tapered wooden termination, fixed with cardboard fins sprayed with graphite, as a matching device. A.

538.566 : 621.396.8

8173. APPLICATIONS OF OPERATIONAL CALCULUS TO GROUND-WAVE PROPAGATION, PARTICULARLY FOR LONG WAVES. H.Bremmer.

I.R.E. Trans Antennas and Propagation, Vol. AP-6, No. 3, 267-72 (July, 1958).

All results of the approximative diffraction theory dealing with the propagation of radio waves around a smooth spherical earth (surrounded by a homogeneous atmosphere) can be derived from a one-dimensional integral equation originally discussed by Hufford. This equation can be solved in terms of operational calculus which leads, first of all, to the well-known residue series. In this treatment the Sommerfeld theory for a flat earth appears at once as a limiting case; moreover, analytic expressions for correction terms accounting for the finite value of the earth's radius are easily determined. Finally, the equation in question can also be used for the extension to inhomogeneous soil conditions, without neglecting the earth's curvature. A.

538.566.2 : 621.372

8174. ABSORPTION IN A DIELECTRIC SLAB. M.P.Bachynski. Canad. J. Phys., Vol. 36, No. 4, 456-61 (April, 1958).

The amount of incident energy transmitted, reflected, and absorbed by a parallel slab of lossy, high-dielectric-constant material is derived. The results are general for any angle of incidence, and calculations are presented for some materials of one-half wavelength electrical thickness. At angles of incidence greater than 60^0, the reflected energy is found to be the smaller the lossier the material. The absorbed energy is a maximum at certain angles of incidence which depend upon the polarization and dielectric constant. A.

538.566.2

8175. THE ROTATION OF THE PLANE OF POLARIZATION OF ELECTROMAGNETIC WAVES IN INHOMOGENEOUS ISOTROPIC DIELECTRICS, WITH SPECIAL REFERENCE TO THE TROPOSPHERE. G.Eckart.

Z. angew. Phys., Vol. 10, No. 8, 393-5 (Aug., 1958). In German.

Using a method of successive approximations the Maxwell equations are solved for the case of a plane wave falling on a region in which the dielectric constant has small arbitrary spatial variations. The formulae are employed to study the resulting changes in the polarization of the wave. P.M.Davidson

538.566.2 : 621.396.968

8176. ACCURATE METHOD FOR CORRECTION OF SLANT RANGE DISTORTION IN HIGH-ALTITUDE RADARS AND A CONTRIBUTION TO THE OPTICS OF REFLECTING CONICAL SURFACES. L.Levi.

J. Opt. Soc. Amer., Vol. 48, No. 10, 680-6 (Oct., 1958).

An optical method for the correction of slant range distortion in high-altitude radar recordings is presented. The line image of the scan is converted into a circular disk by rotation about the zero slant range point and an appropriate line from this disk is selected. This method is strictly geometrical (not an approximation) and readily accomodates altitude changes. The method employs a reflecting cone as an optical element. The laws of reflection and image formation for this element are formulated, including the light efficiency. A simple method for testing the quality of the conical surface is also given. A.

538.566.2

8177. ON THE RADIO WAVE PROPAGATION IN A STRATIFIED ATMOSPHERE. II. R.Yamada.

J. Phys. Soc. Japan, Vol. 12, No. 9, 1022-30 (Sept., 1957).

For Pt I, see Abstr. 2906(1955). A method is developed for determining the electromagnetic field produced by a microwave aerial. The theory is developed for the condition that the index of refraction of the atmosphere varies with height as $A + Bh + Ch^2$, for the flattened earth. From the solution a geometrical-optical description is derived. The Hertzian vector is split into a geometrical series, each term of which corresponds to the rays reflected 1, 2, 3, ... times by the earth, when the "duct" is formed. Among these rays there are rays whose propagation constants are complex numbers. The existence of these explains the "radio duct phenomena" in the cases when the transmitter and the receiver are located out of the "duct", and when they are in and out of the "duct", respectively. For the field strength in the vicinity of the cusp of the caustic, the original integral is used and calculated by

numerical integration. The field strength of the reflected rays at the cusp of the caustic is 3.2 times that of free space for $\lambda = 2\pi$ cm, $b = 5 \times 10^{-8}$/m, $z_0 = 100$ m, $z_1 = z_2 = 60$ m, $r = 62.8$ km. The interference of this strong field of these reflected rays with the weak field of the divergent direct ray may be the cause of the large fading range when the "duct" is formed. A.

538.566.3 : 621.396.8

8178. MULTIPLE REFLECTIONS BETWEEN THE EARTH AND THE IONOSPHERE IN V.L.F. PROPAGATION.
J.R.Wait and A.Murphy.
Geofis. pura appl., Vol. 35, 61-72 (1956/III).

Treating the ionosphere as a sharply-bounded ionized medium, sky-wave field-intensities are calculated by geometrical-optical methods for very low radio frequencies. The reflection coefficients are discussed in some detail and the numerical data are compared with experiment. A.

538.566.3 : 621.396.8

8179. INVESTIGATION OF HORIZONTAL DRIFTS IN THE E REGION OF THE IONOSPHERE IN RELATION TO RANDOM FADING OF RADIO WAVES.
B.Ramachandra Rao and M.Srirama Rao.
J. Brit. Instn Radio Engrs, Vol. 18, No. 8, 493-5 (Aug., 1958).

Regular determination of E region wind velocities (V) and frequency of fading (N) were made from simultaneous fading records at three spaced receivers taken on two pulsed radio frequencies, 2.3 and 2.8 Mc/s respectively, between December 1954 and March 1955. A linear relation between V and N was obtained for each wavelength, and the experimental relation $V = 1.86\ N\lambda$ deduced. This result agrees with theory and the significance of the constant of proportionality is discussed. A.

NUCLEAR AND ATOMIC PHYSICS

APPARATUS. PARTICLE DETECTORS

539.1.07

8180. A C^{14} DATING STATION USING THE CO_2 PROPORTIONAL COUNTING METHOD. I.Olsson.
Ark. Fys., Vol. 13, Paper 3, 37-60 (1957).

A full description of a proportional counter and the associated CO_2 conversion equipment at Uppsala. M.A.Grace

539.1.07

8181. THE DISCHARGE PROCESS IN PROPORTIONAL COUNTER TUBES. C.Keck.
Z. angew. Phys., Vol. 9, No. 6, 286-92 (June, 1957). In German.

A theoretical description of discharge in the proportional region is put forward. Consideration of the intensities and shapes of the electric fields in cylindrical counters yield equations which fit experimental values for the amplification factor A. A is shown to depend more on the radial dimension ρ of the active zone of the counter than on the ionization cross-section. ρ appears to be significantly larger than has been previously assumed. Curves show the variation of A with pressure, applied potential, geometry and with the addition of quenching gases. D.V.Mabbs

539.1.07 : 621.317.723

8182. A DYNAMIC CONDENSER ELECTROMETER SYSTEM FOR BETA PARTICLE DETECTION. S.Fox and R.B.Frank.
I.R.E. Trans Nuclear Sci., Vol. NS-5, No. 2, 27-30 (Aug., 1958).

An electrometer is described for low-level β counting using an ionization chamber. The operation of the instrument and typical applications are outlined. These include C^{14} in gas samples, tritium in gas, and the same isotopes in liquid or solid form. A.

539.1.07 : 539.17

8183. MINIATURE FISSION CHAMBER. J.B.Trice.
Nucleonics, Vol. 16, No. 7, 84, 86-7 (July, 1958).

Constructional details of a chamber containing interchangeable coated electrodes at the end of a probe 15 ft long and 3/4 in. diameter. A constant flow of 97% argon + 3% methane is supplied down the hollow high voltage lead. The total capacitance is 180 pF. R.D.Smith

539.1.07

8184. TRANSISTORIZED, PORTABLE SPARK COUNTER.
E.Laisk.
Nucleonics, Vol. 16, No. 7, 95-7 (July, 1958).

A counter powered by a 9 V dry battery and having interchangeable heads for detection of α-particles or slow neutrons. R.D.Smith

539.1.07 : 621.383.27

8185. ON THE MEASUREMENT OF TRANSIT TIME DISPERSION IN MULTIPLIER PHOTOTUBES. M.H.Greenblatt.
I.R.E. Trans Nuclear Sci., Vol. NS-5, No. 1, 13-16 (June, 1958).

In the use of a multiplier phototube to measure short time-intervals, the accuracy of the measurement is limited by the statistical deviations in the output pulse from the phototube. These deviations arise from variations in the electron transit time in the phototube. A technique is presented by which the transit time dispersion in the tube structure can be measured. A beam of electrons is deflected through an aperture on to the first dynode of the photomultiplier by an r.f. sweep voltage. The output pulse resulting is examined using the sweep voltage as a time base. Values of the order of 1 mμsec were obtained using three commercial-type photomultiplier tubes. A.

539.1.07

8186. A FAST NEUTRON DETECTOR. K.Skarsvåg.
JENER Rep., No. 39, 6 pp. (1955).

A fast neutron detector of the Hornyak type (Abstr. 6782/1952), with and without light guides, is described and its efficiency discussed. A.

539.1.07

8187. SCINTILLATION COUNTER FOR MEASURING RADIOACTIVITY OF VAPOURS. A.E.Lowe and D.Moore.
Nature (London), Vol. 182, 133-4 (July 12, 1958).

A brief account of a C^{14} scintillation counter for use in gas chromatography in which the labelled organic vapour is condensed in a circulating liquid phosphor. M.A.Grace

539.1.07

8188. SINGLE-CHANNEL COUNTER FOR CARBON-14 AND TRITIUM. T.S.Hodgson, B.E.Gordon and M.E.Ackerman.
Nucleonics, Vol. 16, No. 7, 89-94 (July, 1958).

Using a specially selected photomultiplier and a liquid scintillator containing 6 g/l PBD and 100 mg/l POPOP it was found possible to assay tritium at room temperature. R.D.Smith

539.1.07

8189. THE MECHANISM OF PULSE FORMATION IN CRYSTAL COUNTERS WHEN A "THROUGH CONDUCTIVE-CHANNEL" IS FORMED. N.A.Vitovskiĭ, P.I.Maleev and S.M.Ryvkin.
Zh. tekh. Fiz., Vol. 28, No. 3, 460-9 (1958). In Russian.

On the basis of theoretical considerations confirmed by experiments carried out at $-150°$ to $+20°$ C on thin ($< 20\ \mu$) single crystals of CdS with two vacuum-deposited In electrodes, using α-particles of Po^{210} as the ionizing agent, the following conclusions were reached. In thin crystal counters with one electrode, or in thick crystals with two electrodes, the pulse formation is associated with a "through" current, the magnitude of which is limited by the resistance of the "dark regions" of the crystal. In this case the pulse amplitude V_0 is increased when the conductivity σ_0 of the crystal prior to its ionization is increased, e.g. by raising the temperature or by illumination with visible light. When sufficiently thin crystals with two electrodes are used a through-passage of the α-particles is possible, resulting in the formation of a "through conductive-channel", in which case V_0 does not depend on σ_0. The effect of the external potential V, load resistance R, energy of the α-particles E_α, temperature T and illumination with visible light, on V_0 was examined for the latter case. The relationship $V_0 = f(V)$ was linear for all values of R. V_0 increased with increasing R when R was low, and remained approximately constant when R was large. Maximum V_0 corresponded to $E \cong 3$ MeV. V_0 decreased when the crystal was illuminated with visible light, but was not affected by variation of T. Under favourable conditions $V_0 = 20$ volts, or 90% of the applied voltage was obtained, demonstrating the high performance of counters of this type. M.H Sloboda

539.1.07 : 621.383.27

8190. ELECTRON MULTIPLIER NEUTRON DETECTORS.
L.Daum.
I.R.E. Trans Nuclear Sci., Vol. NS-5, No. 2, 30-2 (Aug., 1958).

A standard photomultiplier tube having uranium coated on the cathode is proposed for use in power reactor control. It will cover the neutron flux range from 10^4 to 10^{11} neutrons sec^{-1} cm^{-2} or the range from 10^3 to 10^8 neutrons sec^{-1} cm^{-2}. The electron multiplier

neutron detector will compete with gamma compensated ionization chambers. Electronic discrimination of both gamma induced pulses and the natural alpha activity of the uranium is used to reduce the gamma sensitivity of the system. A.

539.1.07

8191. ELECTRONIC EQUIPMENT FOR MEASURING IONIZATION IN NUCLEAR PLATES. A.De Marco, R.Sanna and G.Tomasini.
Nuovo Cimento, Vol. 9, No. 3, 524-32 (Aug. 1, 1958).

The drum revolution of a motor-driven microscope micrometer eyepiece is read by means of a phototube arrangement giving calibrated electric pulses. The pulses are counted and compared by an equipment incorporating one decade counter tube channel and several condenser storage counters. Final information including track length, mean gap length and gap distribution is directly displayed by electromechanical counters. An analysis of condenser storage counters is given in an appendix. A.

539.1.07 : 778.34

CONCENTRATION OF AN ELEMENT IN A NUCLEAR EMULSION. See Abstr. 7642

539.1.07

8192. SCINTILLATION TRACK CHAMBERS. G.T.Reynolds.
Nucleonics, Vol. 16, No. 6, 60-2 (June,1958).

Filaments about 1 mm in diameter drawn from plastic phosphors function simultaneously as detectors and light guides. By viewing the ends of a rectangular array of filaments a stereoscopic view of charged-particle tracks can be obtained. High gain image intensifier tubes must be used to obtain sufficient intensity for photography of the tracks, but the system has a good inherent signal-to-noise ratio and good time resolution. R.D.Smith

539.1.07 : 537.534

A TEST PULSE GENERATOR FOR USE WITH THE NEUTRON TIME-OF-FLIGHT EQUIPMENT. See Abstr. 8033

539.1.07

8193. A ROBOT DEVICE FOR MEASUREMENT OF ANGULAR DISTRIBUTIONS WITH HIGH ENERGY RESOLUTION.
C.Mileikowsky.
Ark. Fys., Vol. 12, Paper 15, 353-7 (1957).

An automatic method for monitoring a heavy-particle magnetic spectrometer used for angular distribution measurements. M.A.Grace

539.1.07

8194. COMPARISON OF THE SENSITIVITIES OF PARAMAGNETIC ELECTRON RESONANCE SPECTROGRAPHS IN THE 3 cm BAND. J.Roch.
C.R. Acad. Sci. (Paris), Vol 247, No. 1, 59-62 (July 7, 1958).
In French.

The variations of signal intensity and signal-to-noise ratio with cavity coupling coefficient were measured for oscilloscope display spectrometers, in which the power reflected from the sample cavity was monitored by (a) a directional coupler, and (b) a magic T. The two arrangements were found to be exactly equivalent. A.J.Manuel

ELEMENTARY PARTICLES

539.12

8195. POLARIZATION IN HIGH-ENERGY ELASTIC SCATTERING.
L.I.Lapidus.
Zh. éksper. teor. Fiz., Vol. 34, No. 5, 1148-53 (1958). In Russian.

Polarization phenomena in elastic scattering at high energies are considered. It is shown that nucleon beams with a high degree of polarization can be obtained in small-angle scattering. Applicability of the "black nucleus" and "gray nucleus" approximations to high energy p—p scattering is discussed. A.

539.12 : 535.376 : 778.34

8196. CALCULATION OF THE POSITION AND ANGULAR DISTRIBUTION OF STREAMS OF PARTICLES DUE TO MULTIPLE SCATTERING. F.Lenz.
Z. angew. Phys., Vol. 10, No. 1, 31-4 (Jan., 1958). In German.

An expression for the position and angular distribution of particles multiply scattered in a dispersive medium is obtained, the effects of energy loss and absorption being taken into consideration. The theory is applied to the resolving power of fluorescent screens and of photographic plates. A.E.I. Research Laboratory

539.12

8197. POLARIZATION OF PARTICLES WITH SPIN UNITY.
C.B. van Wyk.
Nuovo Cimento, Vol. 9, No. 2, 270-9 (July 16, 1958).

The 3×3 matrix which describes the polarization of a beam of particles with spin unity is discussed. The degree of polarization is defined and the type of polarization discussed in terms of the vector and tensor that occur in the matrix. It is shown that the vector tends to coincide with a principal axis of the tensor. The equivalence of the appropriate special case with the Stokes parameter treatment of the polarization of electromagnetic radiation is indicated. A.

539.12

8198. MONTE CARLO CALCULATION OF AN ELECTRON—PHOTON CASCADE IN LEAD.
V.V.Chavchanidze, R.S.Shaduri and V.A.Kumsishvili.
Zh. éksper. teor. Fiz., Vol. 34, No. 4, 912-15 (1958). In Russian.

A statistical probability method for modelling an electron—photon cascade (in lead) initiated by a γ-quantum is proposed which is based on the method of random tests (a modification of the Monte Carlo method). Some typical curves computed in this fashion are presented. Two methods of performing similar computations with the aid of existing electronic computers are indicated. A.

539.12

8199. PHOTON SCATTERING FROM PROTONS AND DEUTERONS. R.H.Capps.
Phys. Rev., Vol. 108, No. 4, 1032-5 (Nov. 15, 1957).

The scattering of dipole photons of 100 to 200 MeV from protons and deuterons is calculated by means of dispersion relations, experimental data on photopion production from nucleons, and several reasonable approximations. A previous calculation by the author (Abstr. 7349/1957) using this model is modified by the use of an additional dispersion relation derived by Mathews. The differential cross-sections resulting from the modification are smaller than the previously calculated cross-sections for scattering angles in the backward direction. Comparison of the photon-deuteron calculations with the results of future experiments will yield information concerning the photon—neutron scattering amplitude. A.

539.12

8200. RADIATIVE CORRECTIONS TO COMPTON SCATTERING TAKING INTO ACCOUNT POLARIZATION OF THE MEDIUM.
M.I.Ryazanov.
Zh. éksper. teor. Fiz., Vol. 34, No. 5, 1258-66 (1958). In Russian.

A general procedure is developed which permits one to take into account the polarization of the medium in calculating radiative corrections in phenomenological quantum electrodynamics. The effect of a non-conducting medium on radiative corrections to Compton scattering is taken into account for an arbitrary dependence of the dielectric permeability of the medium on the frequency. It is shown that in some cases account of the medium significantly changes the cross-section in the region of small scattering angles. A.

539.12

8201. GAMMA-RAY ATTENUATION WITH BUILDUP IN WATER.
D.G.Chappell.
Nucleonics, Vol. 16, No. 7, 80 (July, 1958).

Nucleonics data sheet No.26. A nomogram giving the attenuation factor for a water shielding slab used with a point source of γ-radiation. R.D.Smith

539.12

8202. SCATTERING OF NEUTRINOS BY ELECTRONS.
V.M.Shekhter.
Zh. éksper. teor. Fiz., Vol. 34, No. 1, 257-8 (1958). In Russian.

A direct 4-fermion interaction $\bar{e}e\bar{\nu}\nu$ with a coupling constant $g = 3 \times 10^{-49}$ erg cm^3 gives a cross-section 3.5×10^{-45} cm^2, which exceeds that obtained from the estimated magnetic moment scattering. G.E.Brown

539.12

8203. CROSS SECTIONS FOR BREMSSTRAHLUNG AND PAIR CREATION INVOLVING POLARIZED ELECTRONS AND PHOTONS.
A.Claesson.
Ark. Fys., Vol. 12, Paper 28, 569-89 (1957).

The differential cross-sections for bremsstrahlung and pair creation involving arbitrarily polarized electrons and linearly and circularly polarized photons are computed. Numerical calculations are made and the cross-sections are determined as functions of the

angle between the scattering planes for circularly polarized photons, definite scattering angles and for four different energies and nine combinations of the polarization directions of the electrons as this is enough to determine the cross-sections for arbitrarily polarized electrons. From the curves thus obtained the maximum value of the cross-sections is plotted as function of the energy of the incoming particle. A.

539.12 : 539.165

8204. DETERMINATION OF THE CIRCULAR POLARIZATION OF THE β-RAYS BREMSSTRAHLUNG WITH A NEW γ-POLARIMETER. E.G.Beltrametti and S.Vitale.
Nuovo Cimento, Vol. 9, No. 2, 289-94 (July 16, 1958).

The circular polarization of the bremsstrahlung produced by P^{32} β-rays was measured with an analyser proposed by Beard and Rose (Abstr. 679/1958). The degree of polarization is found to be consistent with the theoretical previsions. A.

539.12

8205. A PHOTON MONOCHROMATOR FOR BREMSSTRAHLUNG RADIATION FROM A BETATRON. J.Goldemberg.
Rev. Mexicana Fís., Vol. 5, No. 3, 135-52 (July, 1956). In Spanish.

A new instrument was developed in order to sort out monochromatic X-rays of high energy from the continuous bremsstrahlung spectrum of a 22 MeV betatron; the resolution of the instrument was of the order of 2%, Measurements were made of total electronic absorption coefficient in carbon in the energy interval 14.5-16.5 MeV; a good agreement with theory was obtained. See also Abstr. 7697/1954. A.

539.12

8206. RADIATIVE CORRECTIONS TO BREMSSTRAHLUNG. P.I.Fomin.
Zh. éksper. teor. Fiz., Vol. 34, No. 1, 227-8 (1958). In Russian.

The S-matrix is formulated for the system: electron + bremsstrahlung photon + virtual pairs + virtual photons, and used to evaluate the radiative correction terms up to fourth order by the standard Feynman prescriptions (Abstr. 243, 2187/1950, 2964/1952). J.W.Gardner

539.12 : 539.18

8207. VARIATIONAL CALCULATION OF THE SCATTERING OF ELECTRONS OF NEARLY ZERO ENERGY BY HYDROGEN ATOMS. S.Borowitz and H.Greenberg.
Phys. Rev., Vol. 108, No. 3, 716-20 (Nov. 1, 1957).

The cross-section for the scattering of electrons by hydrogen atoms at zero energy is calculated by using a variational principle of the Hulthén–Kohn type. For singlet scattering a three parameter trial function is used which reduces to an H^- wave-function at small electron separations and which has the correct asymptotic form. To calculate triplet scattering an antisymmetrized version of the same trial function is used. The effective range for singlet scattering is determined from the scattering length already calculated and the known value of the electron attachment energy for H^-. For triplet scattering an energy-dependent trial function is used to determine the effective range. Using the calculated values of the above parameters, the cross-section is obtained as a function of energy for the range 0-0.02 volt. A.

539.12

8208. MOTT-SCATTERING ON SCATTERING LAYERS OF FINITE THICKNESS. H.Wegener.
Z. Phys., Vol. 151, No. 3, 252-63 (1958). In German.

Considering the scattering of transversely polarized electrons on a thin layer, the scattering probability is expanded in terms of the thickness d. The d^2 term is calculated as a function of the electron velocity, scattering angle and degree of polarization. The results for gold are compared with experimental findings. P.Roman

539.12

8209. INVESTIGATION OF THE ENERGY DISTRIBUTION OF BACK-SCATTERED ELECTRONS FROM THIN METAL FILMS. H.Kulenkampff and K.Rüttiger.
Z. Phys., Vol. 152, No. 2, 249-60 (1958). In German.

An extension of earlier work on scattering from thick metal electrodes (Abstr. 8341-2/1954). Here the energy spectra of the electrons scattered back from thin films of gold, nickel and aluminium were determined. A continuous distribution of energies is found, ranging from almost zero up to the energy of the incident beam (25 kV), with a maximum in the curve. For Au the position of the maximum is independent of the film thickness, while for Ni and Al the maximum moves to lower energies as the thickness increases. C.Hilsum

539.1

8210. MØLLER SCATTERING OF ARBITRARILY POLARIZED ELECTRONS. A.Raczka and R.Raczka.
Phys. Rev., Vol. 110, No. 6, 1469-71 (June 15, 1958).

The electron–electron cross-section for arbitrarily polarized electrons is given. A curve is shown for the ratio of the polarization dependent part of the cross-section to the independent part, in the transverse case. S.F.Edward

539.12 : 539.1

ELASTIC SCATTERING OF SLOW POSITRONS BY HYDROGEN ATOMS. See Abstr. 7432

539.12

8211. THE SUPPRESSION EFFECT IN IONIZATION BY FAST ELECTRON PAIRS. G.H.Burkhardt.
Nuovo Cimento, Vol. 9, No. 3, 375-99 (Aug. 1, 1958).

Electron pairs of very high energies (about 10^{11} eV) were found by Perkins (Abstr. 1617/1956) to have reduced ionizing power near their origin. The reason is that the angle between the two paths is very small so that over appreciable distances they stay close enough together for their electric fields very nearly to cancel except for atoms very close to the line of travel. The present paper gives a quantum treatment of this effect and the deviations from the semi-classical result are found negligible, in spite of the fact that the general conditions for the validity of classical mechanics are not satisfied. The phenomenon can be used to estimate the energy of the pair. The limitations of this method, both fundamental and practical are discussed. A

539.12

8212. PRODUCTION OF ELECTRON PAIRS BY 550 MeV ELECTRONS. F.J.Loeffler.
Phys. Rev., Vol. 108, No. 4, 1058-62 (Nov. 15, 1957).

The mean free path of high-energy electrons for direct electron pair production was measured in Ilford G-5 nuclear emulsions. Electrons were produced by directing the 850 MeV bremsstrahlung beam from the Cornell synchrotron upon a Pb target and analysing the negative members of the resultant electron pairs in a magnetic momentum analyser. Electrons in the range from 400 to 800 MeV were intercepted by glass-mounted emulsions 400 μ thick and, after processing, the resultant tracks were followed a distance of 1 cm in a search for electron pairs. Separation of bremsstrahlung-produced pairs from the real tridents was achieved by measuring the spatial distribution of the former about the primary tracks. This distribution, after being corrected for scanning efficiency and fitted with the theoretical distribution of Koshiba and Kaplon (Abstr. 451/1956), indicated that for the conditions of this experiment 72% of the events classified initially as tridents were in reality bremsstrahlung pairs. The mean free path for the direct pair-production process was found to be 143 ± 47 cm for a primary electron energy of 536 ± 94 MeV. The theoretical prediction of Racah for this energy is 148 cm and is in good agreement with this experiment. A

539.1

8213. SEARCH FOR PAIR PRODUCTION BY PROTONS. W.E.Stephens and H.Staub.
Phys. Rev., Vol. 109, No. 4, 1196-9 (Feb. 15, 1958).

A search was made for pairs produced in the collision of heavy particles by bombarding tantalum with protons of energy up to 1.64 MeV. Only a very small number of positrons was detected, giving an upper limit of 6×10^{-13} pair per proton at 1.54 MeV, in contrast to the theoretical value of 38×10^{-13} pairs per proton obtained by Born approximation. A

539.12 : 539.1

8214. ON THE DEPENDENCE OF THE PAIR-PRODUCTION CROSS-SECTION ON THE ATOMIC NUMBER. W.Schikarski.
Z. angew. Phys., Vol. 9, No. 11, 541-7 (Nov., 1957). In German.

The pair-production cross-section is measured by total absorption measurement of betatron γ-rays, and subtraction of the known Compton, photo and nuclear absorption cross-sections, for Pb, Sn, Cu, Al, Be, Li. The Z-dependence for heavy elements differs from the prediction of Bethe and Heitler, and the discrepancy, which is accounted for by the failure of Born approximation, is in good agreement with that measured by earlier authors. The factor correcting the Born approximation is assumed in the theoretically established form $b(Z/137)^2$ and the value for b found is in disagreement with a value found earlier by Berman. For light elements the value of g, the ratio of pair-production cross-section of electron and proton, is found to be 0.71 which is nearer to the value 0.68 calculated by Borsellino for the free electron than the results of other authors. H.Mo

539.12

8215. ANGULAR CORRELATION OF ANNIHILATION RADIATION IN ALKALI HALIDE CRYSTALS. W.E.Millett and R.Castillo-Bahena.
Phys. Rev., Vol. 108, No. 2, 257-62 (Oct. 15, 1957).

A new of instrument was used for measurements on Mg metal and single crystals of LiF, NaCl, KCl, KBr, and KI. The data, after correction for instrument resolution, yield the momentum distribution of either the photons or the centre of mass of the positron and electron just prior to annihilation. The momentum distribution obtained for NaCl is accounted for by assuming (a) that the positron is bound to the chloride ion in an s-state, (b) that annihilation takes place with one of the electrons of the closed shell, and (c) that the overlap wave-function is of the form $(r - b)^2 e^{-mr}$. Best agreement with experiment was obtained for 30% of the annihilations taking place with s-electrons for which b = 0.75 A, and m = 3.64 A^{-1} and the other 70% with p-electrons for which b = 0.70 A and m = 4.00 A^{-1}. A.

539.12

8216. POLARIZATION PHENOMENA IN THE ONE-QUANTUM ANNIHILATION OF POSITRONS AND THE PHOTOELECTRIC EFFECT. K.W.McVoy.
Phys. Rev., Vol. 108, No. 2, 365-9 (Oct. 15, 1957).

Cross-sections are derived for the one-quantum annihilation of longitudinally-polarized positrons and for the photoelectric effect with longitudinally-polarized photons. Simple expressions, quantitatively reliable for light elements, are obtained by considering only K-shell electrons and describing the outgoing electron (incoming positron) by plane waves. In both cases, the incoming and outgoing particles have predominantly the same helicity if the free Dirac particle is relativistic. These calculations are extended to the case of elliptically polarized radiation. For linearly polarized photons, the results are compared with those obtained by including lowest-order Coulomb corrections to the continuum wave-function of the electron, as given by Sauter in 1931. The difference in the angular distribution is very marked, and indicates a sensitive dependence on the degree of screening of the Coulomb field. A.

539.12

8217. ANGULAR CORRELATION OF POSITRON ANNIHILATION IN TEFLON. S.D.Warshaw.
Phys. Rev., Vol. 108, No. 3, 713-15 (Nov. 1, 1957).

The angular correlation of the 2-quantum decay of positrons annihilating in a Teflon absorber was measured at room temperature and at 490°K, in each case with a magnetic field of 10 kilogauss and in the absence of the field. The results are consistent with prediction based on the assumption of conversion between triplet and singlet states of positronium. A.

539.12

8218. TWO-PHOTON ANNIHILATION OF POSITRONIUM IN THE P-STATE. A.I.Alekseev.
Zh. éksper. teor. Fiz., Vol. 34, No. 5, 1195-201 (1958). In Russian.

A relativistically invariant expression for the probability amplitude of two-photon annihilation of positronium was obtained by summation of an infinite number of graphs of a certain class. The probability of two-photon annihilation of positronium in the S- and P-states and also the selection rules for these processes were computed in the non-relativistic limit. A.

539.12

8219. EQUALITY BETWEEN THE INTERACTION CROSS-SECTIONS OF HIGH-ENERGY NUCLEONS AND ANTINUCLEONS. I.Ya.Pomeranchuk.
Zh. éksper. teor. Fiz., Vol. 34, No. 3, 725-8 (1958). In Russian.

On basis of the dispersion relations the equality between the interaction cross-sections of high-energy nucleons and antinucleons is demonstrated. A.

539.12

8220. POSSIBLE EXPERIMENTS FOR INVESTIGATION OF INELASTIC SCATTERING OF NUCLEONS. I. L.M.Soroko.
Zh. éksper. teor. Fiz., Vol. 34, No. 1, 87-96 (1958). In Russian.

Possible experiments for investigation of inelastic collisions of nucleons in accord with the scheme $N + N \rightarrow \pi + N + N'$, which represents the most intense process in the ~ 650 MeV region, are considered. Some non-trivial experiments on the angular correlations of π-mesons and nucleons based on the existence of azimuthal asymmetry in the emission of these particles are suggested. Analogous effects in a polarized nucleon beam are also considered. The calculations are carried out in terms of ten inelastic transition amplitudes which are assumed to yield the main contribution to the total cross-section for the process $N + N \rightarrow \pi + N + N'$ at energies of the order of 650 MeV. A.

539.12

8221. MEASUREMENT OF THE MASS OF 660 MeV PROTONS. V.P.Zrelov, A.A.Tyapkin and P.S.Farago.
Zh. éksper. teor. Fiz., Vol. 34, No. 3, 555-8 (1958). In Russian.

Measurements of the momentum p and velocity v of 660 MeV protons were carried out in the external beam of a synchrocyclotron. The mass $m_1 = p/v$ was compared with the value computed in accord with the relativistic relation $m_2 = m_0 [1 - v^2/c^2]^{-1/2}$. Within the limits of the experimental errors both mass values are in agreement. The observed relative deviation was $\Delta m/m = 0.004$. A.

539.12

8222. ELASTIC SCATTERING OF 40 MeV PROTONS BY DEUTERONS. J.H.Williams and M.K.Brussel.
Phys. Rev., Vol. 110, No. 1, 136-8 (April 1, 1958).

Measurements of the differential cross-section for elastic scattering of 40 MeV protons by deuterons over the range of proton laboratory angles from 4° to 164° are reported. The results for angles greater than 90° were obtained by observing the recoil deuterons emitted in the forward direction. The cross-section exhibits a sharp minimum at 7° and a broad minimum at approximately 110°. A.

539.12

8223. POLARIZATION MEASUREMENTS IN p—α ELASTIC SCATTERING. M.J.Scott.
Phys. Rev., Vol. 110, No. 6, 1398-405 (June 15, 1958).

The polarization of protons elastically scattered from alpha-particles was observed by measuring the asymmetry obtained by doubly scattering protons in helium. Protons from the Brookhaven National Laboratory Van de Graaff generator entered a helium-filled double-scattering chamber through a 50 μin. nickel window. The first scattering was at either 104°29' (c.m.) or 73°38' (c.m.) and the second scattering was to left and right at 73°38' (c.m.). The doubly-scattered protons were detected by 50 μ Ilford C-2 plates. The polarization product $P_a P_b$ was calculated from the left–right ratio R using the formula $R = (1 + P_a P_b)/(1 - P_a P_b)$, where P_a and P_b are the polarizations at the first and second scatterings, respectively. Three interdependent measurements, in which $P_a P_b$ was equal to $P_1 P_2$, $P_1 P_3$, or $P_2 P_3$, yielded values for P_1[3.580 MeV, 104°29' (c.m.)], P_2[2.020 MeV, 73°38' (c.m.)] and P_3[1.375 MeV, 73°38' (c.m.)]. The calculated polarizations are in the direction of the normal n $(n = k_0 \times k/|k_0 \times k|)$ to the scattering plane. The following results were obtained:

Polarization measured	Experimental value (%)	Calculated value (%)
P_1	54 ± 2	+59 ± 13
P_2	85 ± 3	+80 ± 4
P_3	62 ± 2	+59 ± 16

A.

539.12

8224. A MEASUREMENT OF THE SPIN CORRELATION COEFFICIENT C_{nn} IN P—P SCATTERING AT 382 MeV, FOR 90° CENTRE OF MASS SCATTERING ANGLE.
A.Ashmore, A.N.Diddens, G.B.Huxtable and K.Skarsvåg.
Proc. Phys. Soc., Vol. 72, Pt 2, 289-93 (Aug., 1958).

The spins of the two protons were measured in coincidence by second scatterings in the same plane at a laboratory angle of 12° from carbon targets. The value obtained for C_{nn} was +0.416 ± 0.084, which gives 70.8 ± 4.2% of the scattering in triplet states and 29.2 ± 4.2% in single states. This value of C_{nn} is similar to that from the potential model of Gammel and Thaler, but does not clearly exclude any of the five possible Berkeley phase-shifts at 310 MeV.
E.J.Burge

539.12

8225. USE OF AN OPTICAL MODEL [OF THE NUCLEON] FOR ANALYSIS OF π^-p AND p—p SCATTERING AT HIGH ENERGIES. V.G.Grishin, I.S.Saitov and I.V.Chuvilo.
Zh. éksper. teor. Fiz., Vol. 34, No. 5, 1221-9 (1958). In Russian.

The π^-p and p—p scattering at energies above 1 GeV in the laboratory system is analysed on basis of a model of the nucleon according to which the latter is considered as an optically homogeneous sphere with sharp boundaries and a complex refraction index. It is demonstrated that the available experimental data can be described by choosing a sphere of radius $R = (1.08 \pm 0.07) \times 10^{-13}$ cm which is independent of the type of the interacting particles or of their energy. The optical characteristics of the sphere are computed. The contribution to the elastic scattering cross-section of the imaginary and real parts of the scattering amplitude are estimated. For π-meson energies of 1.37 GeV and proton energies above 5 GeV

the contribution from the real part of the scattering amplitude is small and thus at higher energies analysis of scattering can be carried out on a basis of the general scattering theory without taking into account the spin characteristics of the interaction, or else on the basis of the model of a purely absorbing sphere. The possible behaviour of the cross-sections for π–p and p–p interaction with increase of the energy of the colliding particles is discussed. A.

539.12

8226. DIRECTION OF POLARIZATION PRODUCED BY QUASI-ELASTIC SCATTERING OF 315 MeV PROTONS.
H.Bradner and W.Isbell.
Phys. Rev., Vol. 108, No. 2, 463-5 (Oct. 15, 1957).

Protons scattered quasi-elastically with energy 315 MeV at 13° from a beryllium target in the Berkeley synchrocyclotron were brought out of the machine, slowed by absorbers, and scattered in helium at 765 lb/in^2 absolute pressure. Scattering events at angles of $90^\circ \pm 22.5^\circ$ were detected in nuclear emulsions. Observed asymmetries in left versus right scattering of protons with energies below 14 MeV were used, in conjunction with phase shifts from p–He scattering data, to compute the direction of spin polarization. Spin was found up from left scattering in agreement with the predictions of spin-orbit coupling theory and with the findings of other experimenters. A.

539.12

8227. EXPERIMENTS ON ANTIPROTONS: ANTIPROTON–NUCLEON CROSS SECTIONS. O.Chamberlain, D.V.Keller, R.Mermod, E.Segrè, H.M.Steiner and T.Ypsilantis.
Phys. Rev., Vol. 108, No. 6, 1553-6 (Dec. 15, 1957).

Experiments are reported on annihilation and scattering of antiprotons in H_2O, D_2O, and O_2. From the data measured it is possible to obtain an antiproton–proton and an antiproton–deuteron cross-section at 457 MeV (lab). Further analysis gives the $\bar{p}$–p and $\bar{p}$–n cross-sections as 104 mb for the $\bar{p}$–p reaction cross-section and 113 mb for the $\bar{p}$–n reaction cross-section. The respective annihilation cross-sections are 89 and 74 mb. The Glauber correction necessary in order to pass from the $\bar{p}$–d to the $\bar{p}$–n cross-section by subtraction of the $\bar{p}$–p cross-section is unfortunately large and somewhat uncertain. The data are compared with the p–p and p–n cross-sections and with other results on $\bar{p}$–p collisions. A.

539.12

8228. ON SOLUTION OF THE KINETIC EQUATION FOR TRANSFER OF NEUTRONS OR GAMMA QUANTA BY THE PARTIAL PROBABILITY METHOD. I.G.Dyad'kin.
Zh. éksper. teor. Fiz., Vol. 34, No. 6, 1504-17 (1958). In Russian.

Solution of the kinetic equation for slowing down or diffusion of neutrons and propagation of γ-quanta is reduced to the simpler problem of multiple integration. An exact solution of the kinetic equation (stationary as well as non-stationary) is found in the form of a sum whose κ-th term is approximately a 3κ-fold integral. The latter has the meaning of the transition probability of a particle from one point in its phase space to another after κ collisions. In the particular case of slowing down and diffusion of neutrons with a constant mean free path, it is shown that this exact solution, which depends on all six variables (three space coordinates and three momentum projections) can be reduced to simple quadratures and sums. A.

539.12 : 538.221

NEUTRON IRRADIATION EFFECTS ON MAGNETIC MATERIALS. See Abstr. 8115

539.12

8229. MEASUREMENTS OF THE EFFECTIVE RESONANCE INTEGRAL IN URANIUM METAL AND OXIDE IN DIFFERENT GEOMETRIES. E.Hellstrand.
J. appl. Phys., Vol. 28, No. 12, 1493-502 (Dec., 1957).

A series of measurements of the effective resonance integral in uranium metal and oxide, UO_2, was made. Measurements were performed on simple rods, on tubes (empty or filled with a moderator) and on clusters of rods. Formulae for the effective resonance integral as a function of S/M and $(S/M)^{1/2}$ are given for metal and UO_2. In addition the variation of the resonance absorption of neutrons as a function of depth in metal rods was studied. The results are given in the form of curves. A.

539.12 : 551.579.5

NEUTRON SCATTERING METHOD OF MEASURING SOIL WATER CONTENT. See Abstr. 7636

539.12 : 539.19

μ-MESONIC MOLECULAR IONS AND NUCLEAR CATALYSIS. See Abstr. 7476

539.12

8230. DEPENDENCE OF THE ANGULAR CORRELATION IN μ^-–e^- DECAYS ON ENERGY.
Yu.M.Ivanov and V.G.Kirillov-Ugryumov.
Zh. éksper. teor. Fiz., Vol. 34, No. 1, 255-6 (1958). In Russian.

A study of 135 decays in emulsion gives qualitative support for the two-component neutrino theory. W.O.Lock

539.12

8231. THE SCATTERING OF μ-MESONS IN LEAD AND COPPER
W.F.Nash and A.J.Pointon.
Nuovo Cimento, Vol. 9, No. 3, 412-21 (Aug. 1, 1958).

The scattering distributions of μ-mesons in lead and copper were investigated using a cloud chamber operated underground at a depth of 40 m w.e. At high momenta the observed scattering distributions are similar to those given by Molière for a "point" nucleus at large angles. It is shown that the results are consistent with a cross-section that varies as A^2 or Z^2 but not as Z or A. A.

539.12

8232. THE CALCULATION OF THE NUCLEAR QUADRUPOLE SCATTERING OF POSITIVE MUONS IN A WEAK RELATIVISTIC ENERGY REGION. J.v.Behr.
Z. Phys., Vol. 150, No. 3, 311-24 (1958). In German.

The influence of the nuclear quadrupole moment on the scattering of 27 MeV positively charged muons on heavy nuclei is calculated. The quadrupole potential and the spin–orbit coupling are considered as perturbations on the spherically symmetrical interaction, enabling the Dirac equation to be solved by a perturbation method. The various contributions to the scattering cross-section are calculated in detail and compared graphically with the results using the Born approximation. M.J.Kearsley

539.12

8233. CORRELATED POLARIZATION OF MUONS IN $K_{\mu 3}$-DECAY
S.W.MacDowell.
Nuovo Cimento, Vol. 9, No. 2, 258-62 (July 16, 1958).

The relativistic density matrix formalism developed by Stapp is used to calculate the polarization vector of muons from $K_{\mu 3}$-decay and the depolarizing effects due to high energy atomic collisions. A

539.12

8234. ANGULAR DISTRIBUTION OF POSITRONS FROM π^+–μ^+–e^+ DECAYS IN PROPANE. A.I.Alikhanyan, V.G.Kirillov-Ugryumov, L.P.Kotenko, E.P.Kuznetsov and Yu.S.Popov.
Zh. éksper. teor. Fiz., Vol. 34, No. 1, 253-4 (1958). In Russian.

The coefficient A in the angular distribution $(1 + A\cos\theta)$ is found to be -0.22 ± 0.03, equivalent to $a = 0.33 \pm 0.06$ in $dN/d\Omega = (1 + a\cos\theta)$, based on 6670 events in a propane bubble chamber. W.O.Lock

539.12

8235. ASYMMETRY IN THE ANGULAR DISTRIBUTION OF μ^+–e^+ DECAY ELECTRONS OBSERVED IN PHOTOGRAPHIC EMULSIONS. I.I.Gurevich, V.M.Kutukova, A.P.Mishakova, B.A.Nikol'skii and L.V.Surkova.
Zh. éksper. teor. Fiz., Vol. 34, No. 2, 280-5 (1958). In Russian.

Results of measurement of the angular distributions of π–μ–e decay electrons observed in a photographic emulsion located within a magnetic shield and in a magnetic field (~ 1100 G) which was longitudinal with respect to the μ-meson motion, are presented. The electron angular distributions were found to be described by a relation of the form $1 + a\cos\theta$. The values of parameter a were $-(0.092 \pm 0.018)$ and $-(0.16 \pm 0.04)$ for the emulsion in the magnetic field respectively. A

539.12

8236. ANGULAR ANISOTROPY IN π^+–μ^+–e^+ DECAY OBSERVED IN A PROPANE BUBBLE CHAMBER.
A.I.Alikhanyan, V.G.Kirillov-Ugryumov, L.P.Kotenko, E.P.Kuznetsov and Yu.S.Popov.
Zh. éksper. teor. Fiz., Vol. 34, No. 5, 1101-9 (1958). In Russian.

The angular anisotropy in μ^+–e^+ and π^+–μ^+ decays was measured. The dependence of the μ^+–e^+ decay anisotropy on the electron energy is not inconsistent with the two-component neutrino theory. The π^+–μ^+ decays do not display angular anisotropy. A

539.12 : 530.12

PION—MUON DECAY IN FLIGHT. "SPIN DIRECTION" TRANSFORMATION. See Abstr. 7679

539.12

8237. ENERGY SPECTRUM OF CHARGED PIONS FROM 1.2 BeV PROTONS ON Be.
F.L.Niemann, J.K.Bowker, W.M.Preston and J.C.Street.
Phys. Rev., Vol. 108, No. 5, 1331-40 (Dec. 1, 1957).

Nuclear emulsions were exposed to the radiations produced by 1.2 Bev protons incident upon an internal beryllium target in the Brookhaven Cosmotron. Particles were identified and their energies determined by grain counts and multiple scattering measurements. Approximately 100 pion tracks were studied at each of three laboratory angles, 12°, 18° and 36°, with respect to the direction of the incident beam. Assuming a simple nucleon—nucleon interaction in the target, these data correspond to spectra near 30°, 50°, and 90° in the centre-of-mass system of two nucleons. Over this angular range, the portion of the spectrum near 100 MeV is roughly isotropic, while in the 200 to 300 MeV range it is strongly anisotropic. A comparison of these and other results with recent calculations based on the isobar model reveal certain basic inconsistencies. The observed angular distributions appear qualitatively to be more in agreement with those to be expected from the statistical theory modified to include the final-state particle interactions and the conservation of angular momentum. A.

539.12

8238. INTERACTIONS OF 1.3 BeV NEGATIVE PIONS IN NITROGEN. G.D.Gordon, R.H.Milburn, J.C.Street and L.A.Young.
Phys. Rev., Vol. 108, No. 5, 1315-21 (Dec. 1, 1957).

Seventy-four inelastic pion—nitrogen interactions were studied using a diffusion cloud chamber provided with a magnetic field. Distributions were made of the momenta, emission angles, and charges of the various nuclear and mesonic fragments, including a number of neutral pions and a hyperon, from these interactions. It is found that the induced excitation of the nitrogen nucleus can lead to a breakdown into from two to seven charged nuclear fragments. Evidence for multiple pion scattering within single nuclei is discussed. A.

539.12 : 539.17

BREMSSTRAHLUNG OF π-MESONS AND π-MESON PAIR FORMATION. See Abstr. 7392

539.12

8239. π^-—p ELASTIC SCATTERING AT 1.44 BeV.
M.Chretien, J.Leitner, N.P.Samios, M.Schwartz and J.Steinberger.
Phys. Rev., Vol. 108, No. 2, 383-9 (Oct. 15, 1957).

An investigation of π^- + p elastic scattering, made in a liquid-propane bubble-chamber, is reported. Identification of events is made on the basis of kinematics. The problem of contamination by pion scattering from protons bound in carbon is considered in some detail; it is shown that the latter requires a correction of only 1 ± 2.5% of the total number of events. The angular distribution is presented. It shows a large diffraction peak at small angles and an approximately isotropic plateau over the backward hemisphere. The forward peak is fitted to a black-sphere diffraction pattern with a radius of $(1.08 \pm 0.06) \times 10^{-13}$ cm. The total elastic cross-section is found to be $\sigma_e = 10.1 \pm 0.08$ mb. A.

539.12

8240. Z DEPENDENCE OF POSITIVE PION PRODUCTION BY PHOTONS. W.Imhof, E.A.Knapp, H.Easterday and V.Perez-Mendez.
Phys. Rev., Vol. 108, No. 4, 1040-6 (Nov. 15, 1957).

The relative yield of positive pions from H, C, Al, Cu, Ag, and Pb produced by 335 MeV bremsstrahlung was measured with a counter telescope at 5 angles to the beam line ranging from 45° to 150° and at 9 meson energies extending from 12 to 125 MeV. The pion production cross-sections at all angles and at all energies of 35 MeV or lower follow approximately a $Z/A^{1/3}$ dependence. Fair agreement with the optical model is obtained at the lower energies, provided account is taken of effects of the Coulomb potential and the potential arising from the pion—nucleon interaction. In the intermediate region from 22.5 to 65 MeV, the yields from the heavy nuclei are somewhat lower than predicted. At pion energies of 95 and 125 MeV, where the production cross-sections follow more nearly a Z dependence, it is possible to get moderately good agreement with theory by considering the effects of the Coulomb potential on the production near the cutoff energy. A.

539.12

8241. SELECTION RULES FOR PION PRODUCTION IN NUCLEON—ANTINUCLEON SCATTERING. S.Barshay.
Phys. Rev., Vol. 109, No. 2, 554-6 (Jan. 15, 1958).

Selection rules governing the production of one and two pions in nucleon—antinucleon scattering are derived by utilizing conservation of the quantum numbers associated with the total angular momentum, the total isotopic spin, parity, the charge-conjugation operation, and the combined charge-conjugation, charge-symmetry operation. A.

539.12 : 539.17

8242. REACTION p + p → π^+ + d IN THE 425 MeV ENERGY REGION.
T.H.Fields, J.G.Fox, J.A.Kane, R.A.Stallwood and R.B.Sutton.
Phys. Rev., Vol. 109, No. 5, 1704-12 (March 1, 1958).

The 437 MeV external proton beam of the Carnegie Institute of Technology synchrocyclotron was used to measure the angular distribution and total cross-section of the reaction p + p → π^+ + d. The proton beam impinged upon liquid hydrogen, and the resulting positive pions were detected in fast coincidence with their associated deuterons. The differential cross-section was measured at seven pion centre-of-mass angles in the range from 30° to 130°. Several corrections were applied to the observed counting rates, including a downward correction of about 7% to compensate for coincidence counts which arose from the reaction p + p → π^+ + p + n. The corrected total cross-section for the reaction p + p → π^+ + d is 1.23 ± 0.07 mb, with a centre-of-mass angular distribution proportional to $(0.23 \pm 0.02) + \cos^2\theta$. In addition, a 53% polarized proton beam of energy about 415 MeV was used to measure azimuthal asymmetries in the p + p → π^+ + d reaction. The experimental technique was very similar to that used for the production cross-section measurements. The asymmetry ϵ, defined as the difference divided by the sum of the pion intensities on the right and left, was measured at pion centre-of-mass angles of 90° and 50°. The magnitudes of the measured asymmetries were $\epsilon(90^\circ) = 0.20 \pm 0.03$ and $\epsilon(50^\circ) = 0.023 \pm 0.015$ in such a sense that the greatest meson intensity was on the left when the polarized beam originated in a scattering to the right. The results of the cross-section and asummetry measurements are discussed in relation to phenomenological analyses of the threshold behaviour of the p + p → π^+ + d reaction. A.

539.12

8243. TOTAL CROSS SECTION FOR THE REACTION p + p → π^+ + p + n AT 437 MeV.
T.H.Fields, J.G.Fox, J.A.Kane, R.A.Stallwood and R.B.Sutton.
Phys. Rev., Vol. 109, No. 5, 1713-15 (March 1, 1958).

The total cross-section for the reaction p + p → π^+ + p + n was measured for 437 MeV incident protons. The value obtained is 1.06 ± 0.24 millibarn,which is lower than some earlier measurements have indicated. The present result gives better agreement with the value predicted by the phenomenological theory and the measured cross-section for p + p → π^+ + d. A.

539.12

8244. ON THE RELATIONS BETWEEN THE CROSS-SECTIONS FOR MULTIPLE PRODUCTION OF π-MESONS. N.V.Dushin.
Zh. éksper. teor. Fiz., Vol. 34, No. 4, 916-21 (1958). In Russian.

Isotopic relations were obtained between the cross-sections of transformation of a π-particle and a γ-quantum into three π-particles during collisions between the π-meson or γ-quantum and nucleons or deuterons. It is shown that some auxiliary relations hold near the threshold of the reaction and the formation of π-particles with identical moments. A.

539.12

8245. SOME FEATURES OF THE PROCESS OF CHARGED π-MESON PRODUCTION ON CARBON BY 670 MeV PROTONS.
L.S.Azhgirei, I.K.Vzorov, V.P.Zrelov, M.G.Meshcheryakov and Petrukhin,V.I.
Zh. éksper. teor. Fiz., Vol. 34, No. 6, 1357-66 (1958). In Russian.

A specially designed magnetic spectrometer was employed to measure the energy spectra of π^+- and π^--mesons produced in p + C collisions. The measurements were carried out at an angle of 56° to the proton beam. The π-meson (+ and −) spectra were found to possess a maximum at about 110 MeV and could still be detected as far as ~ 400 MeV. Smearing out of the high-energy side of the spectrum is interpreted as indicating partial formation of π-mesons within the nuclei on correlated nucleon groups with large relative momenta. The differential cross-sections for π^+ and π^--meson formation were found to be $(5.1 \pm 0.8) \times 10^{-27}$ and $(1.0 \pm 0.2) \times 10^{-27}$ cm²/sterad. In the c.m.s. of the two colliding nucleons the π^+ and π^--meson angular distributions are close to isotropic. The measured ratio of the π^+ and π^--meson yields is not consistent with the predictions of the simple model of π-meson production via excitation

of the nucleon to an intermediate state with T = J = 3/2 and indicates that inelastic collisions in the state with T = 0 play a significant role. A.

539.12

8246. ENERGY SPECTRA AND ANGULAR DISTRIBUTIONS OF π^+-MESONS PRODUCED ON CARBON BY 660 MeV PROTONS.
A.G.Meshkovskiĭ, Ya.Ya.Shalamov and V.A.Shebanov.
Zh. éksper. teor. Fiz., Vol. 34, No. 6, 1426-33 (1958). In Russian.

The energy spectra of π^+-mesons produced by 660 MeV protons on carbon were measured at five angles from 19°30' to 65°. The absolute cross-sections $d\sigma_+/d\Omega$ were also measured. In the c.m.s. of the two colliding nucleons the mean π^+-meson energy was found to be independent of the angle of emission and was 100 MeV. Conclusions are drawn concerning the angular distribution of π^+-mesons; the total cross-section for their production on carbon by 660 MeV protons is estimated and found to be $(46.7 \pm 5.1) \times 10^{-27}$ cm^2. The probability for production of π^+-mesons in p–p collisions in the carbon nucleus is twice as small as the analogous probability for free p–p collisions. A.

539.12 : 530.145

8247. K-MESON CONTRIBUTION TO FORCES BETWEEN BARYONS. D.B.Lichtenberg and M.Ross.
Phys. Rev., Vol. 109, No. 6, 2163-9 (March 15, 1958).

A fourth-order perturbation theory calculation is made of baryon–baryon forces arising from the exchange of K-mesons. Results are compared with experiment. If it is assumed that the K-meson is coupled equally to all baryons, while the pion is coupled weakly to hyperons, it is found (for either scalar or pseudoscalar K) that the Λ-nucleon potential does not have the right spin-dependence to give agreement with binding energies in hyperfragments. If, on the other hand, it is assumed that the pion is coupled with the same strength to all baryons, then one can obtain agreement with experiment if the baryon–baryon potentials arising from K exchange are small. This is not inconsistent with fairly large K coupling-constants. These conclusions, however, become tenuous if K-baryon couplings are as strong as the π-nucleon coupling (for example, if the PS coupling constants are comparable). A.

539.12

8248. ON THE ABUNDANCES OF THE $K_{\mu 3}$ AND K_{e3} DECAY MODES OF POSITIVE K MESONS.
M.Bruin, D.J.Holthuizen and B.Jongejans.
Nuovo Cimento, Vol. 9, No. 3, 422-32 (Aug. 1, 1958).

The abundances of the $K_{\mu 3}$ and K_{e3} decay modes were checked in a large stack of Birge et al., using the additional criteria of Alexander et al. The results agree completely with those of Birge et al. The weighted average of these and comparable corrected results of others yields a relative abundance of (3.9 ± 0.5)% for $K_{\mu 3}$ and of (5.1 ± 0.8)% for K_{e3} decay. Available experimental data on the electron spectrum of the K_{e3} decay mode are compiled and compared with theoretical calculations by Furuichi et al. No evidence is found for an abnormally short mean free path of the positive secondary pions from $K_{\pi 2}$ decay as previously reported by Alexander et al. A.

539.12

8249. $K_{\mu 3}$ DECAY: TESTS FOR TIME REVERSAL AND THE TWO-COMPONENT THEORY. J.J.Sakurai.
Phys. Rev., Vol. 109, No. 3, 980-3 (Feb. 1, 1958).

The $K_{\mu 3}$ decay is investigated with special attention to possible muon polarization normal to the decay plane $[\sigma_\mu . (p_\pi \times p_\mu)]$ which can be detected by observing an "up–down" asymmetry in the electron distribution in the subsequent parity-nonconserving muon decay. If the K particle is spinless or is unpolarized, the presence of such polarization would indicate that invariance under time reversal is violated in the $K_{\mu 3}$ decay. This polarization is calculated field-theoretically for the spinless K particle. In addition a sensitive test for the two-component theory of the neutrino is proposed for the decay configuration in which the three decay products are collinear. A.

539.12

8250. STRANGE PARTICLE DECAYS IN THE FEYNMAN AND GELL-MANN THEORY. I.Yu.Kobzarev and I.E.Tamm.
Zh. éksper. teor. Fiz., Vol. 34, No. 4, 899-901 (1958). In Russian.

An explanation is proposed for the equal probability of K_{e3} and $K_{\mu 3}$ decays in the absence of K_{e4} decay, and also for the large asymmetry observed in the decay of polarized hyperons. A universal A–V Gell-Mann and Feynman interaction is assumed. A.

539.12

8251. ON K_{e3} DECAY. I.G.Ivanter.
Zh. éksper. teor. Fiz., Vol. 34, No. 5, 1202-6 (1958). In Russian.

The possibility is considered of determining the interaction constants and properties of the neutrino by studying the polarization and spectra of particles emitted in K_{e3} decays. A.

539.12

8252. COSMIC-RAY MEASUREMENT OF τ^- AND K-MESON MEAN LIVES.
J.W.Keuffel, G.J.Morris, R.K.Stitt, R.L.Call and W.H.Sandmann.
Phys. Rev., Vol. 108, No. 6, 1584-8 (Dec. 15, 1957).

The mean lifetimes of τ and K mesons were measured using mesons produced by the cosmic radiation in a large generating layer of brick and Pb. The particles come to rest in a 64 kg liquid scintillation detector, where they are identified by pulse-height and by the time pattern of 2.2 μsec decay electrons arising from the heavy-meson secondaries. A novel pulse-forming circuit generates a fiducial pulse at time zero and a pulse corresponding to the heavy-meson decay, all within the same scintillator. A sample of 158 K particles, mostly $K_{\mu 2}$, yields a lifetime value of $(10.9 \pm 1.3) \times 10^{-9}$ sec. The lifetime of the τ is $(11.3^{+4.0}_{-2.3}) \times 10^{-9}$ sec, based on 20 events. These results are in good agreement with values obtained at the accelerators. A.

539.12 : 539.14

SPINS AND PARITIES OF THE K-MESON. See Abstr. 7312

539.12

8253. K-MESON–NUCLEON INTERACTIONS AND THE RELATIVE Σ–Λ PARITY. S.Barshay.
Phys. Rev. Letters, Vol. 1, No. 3, 97-8 (Aug. 1, 1958).

By considering, in a nonrelativistic approach, K-meson–nucleon scatterings with and without charge exchange and the relative infrequency of Λ particles produced in K^-–p interactions, it is conjectured that the K–Λ relative parity is odd and the K–Σ relative parity is even, relative to the nucleon. P.Roman

539.12

8254. PRODUCTION CROSS SECTIONS OF K^+ MESONS BY 3 BeV PROTONS ON H, Li, AND Cu.
P.Baumel, G.Harris, J.Orear and S.Taylor.
Phys. Rev., Vol. 108, No. 5, 1322-6 (Dec. 1, 1957).

Liquid hydrogen, lithium, and copper targets were exposed to the Cosmotron external proton beam. Nuclear emulsion stacks were used to detect momentum-analysed K^+ and π^+ mesons of momentum 280 MeV/c leaving the target at 0° in the laboratory system. Correcting for decay in flight, the π^+/K^+ ratios are (630 ± 110), (290 ± 48), and (304 ± 50) for the respective hydrogen, lithium, and copper targets. The laboratory system differential cross-sections for K^+ production are $(4.8 \pm 1.0) \times 10^{-33}$, $(3.5 \pm 0.7) \times 10^{-31}$, and $(3.0 \pm 0.6) \times 10^{-30}$ cm^2/sterad MeV per hydrogen, lithium, and copper nucleus respectively. Assuming a K^+ energy dependence proportional to the final state density (energy independent matrix element) the integrated K^+ production cross-sections are 0.21, 1.7 and 14.7 millibarns for hydrogen, lithium, and copper. For a matrix element proportional to the K^+ momentum in the centre-of-mass and assuming a $\cos^2\theta$ distribution the p–p cross-section also happens to be 0.21 millibarns. The π/K ratios indicate that K^+ production by p–p is not suppressed significantly relative to that by p-nucleus and that the Li to Cu Z-dependence of K^+ production appears the same as for π^+ production. The integrated cross-sections suggest that strange particle production by 3 BeV protons occurs ~ 1% of the time. A.

539.12

8255. PRODUCTION OF V-PARTICLES BY 3 BeV PROTONS.
R.L.Cool, T.W.Morris, R.R.Rau, A.M.Thorndike and W.L.Whittemore.
Phys. Rev., Vol. 108, No. 4, 1048-52 (Nov. 15, 1957).

With a well-collimated beam of 3 BeV protons and a hydrogen-filled diffusion cloud chamber a search was made for V-particles from p–p collisions. The rarity of such events leads to the conclusion that the V-production cross-section is probably less than 0.2 millibarn. This value is significantly smaller than the ~ 1 millibarn V-production cross-section observed for π^-–p collisions at comparable centre-of-mass energies. At the same time a cross-section of 7.4 ± 1.5 millibarn is obtained for iron (per nucleus). A direct comparison of p–p and p–Fe interactions under essentially similar conditions allows one to conclude that an interaction with an iron nucleus is at least 4 times more effective in producing V's than is an interaction with a free proton. A.

539.12

8256. PARITY NON-CONSERVATION DURING HYPERON DISINTEGRATION. H.A.Tolhoek.
Ned. Tijdschr. Natuurkde, Vol. 24, No. 7, 182-5 (July, 1958). In Dutch.

539.12

8257. A SEMIPHENOMENOLOGICAL THEORY OF Σ^+ HYPERON—PROTON SCATTERING UP TO 150 MeV.
R.A.Bryan, J.J. de Swart, R.E.Marshak and P.S.Signell.
Phys. Rev. Letters, Vol. 1, No. 2, 70-2 (July 15, 1958).

Assuming a universal pion—baryon coupling, the Signell—Marshak semi-phenomenological nucleon—nucleon potential was used to calculate Σ^+—proton scattering. Neglecting K-meson coupling the Σ^+—proton interaction is identical with the nucleon—nucleon interaction in the T = 1 state. Since the Pauli principle does not apply this interaction is assumed for both even and odd states of the Σ^+—p system. It was necessary to cut off the deep triplet central potential in the even parity states in order to avoid a strongly bound state for which there is no experimental evidence. Phase-shifts, differential cross-sections and Σ^+ polarization are given for 40, 100 and 150 MeV. The cross-sections show strong forward peaking which could be checked experimentally.

S.J.Goldsack

539.12

8258. OBSERVATION OF UNPOLARIZED Λ^0'S PRODUCED BY 1.5 BeV π^- INTERACTIONS IN Pb, Fe, and C. T.Bowen, J.Hardy, Jr, H.T.Reynolds, G.Tagliaferri, A.E.Werbrouck and W.H.Moore.
Phys. Rev. Letters, Vol. 1, No. 1, 11-12 (July 1, 1958).

No significant asymmetries were detected in the decay planes of 1.38 Λ^0s created in the lead, iron and carbon plates of a multiplate cloud-chamber exposed to a 1.5 BeV π^- beam. S.J.Goldsack

NUCLEUS

539.14

8259. FRACTIONAL PARENTAGE COEFFICIENTS FOR THE WAVE-FUNCTION OF FOUR PARTICLES. G.I.Zel'tser.
Zh. éksper. teor. Fiz., Vol. 34, No. 3, 694-9 (1958). In Russian.

General formulae are obtained for a fractional parentage expansion of the $\langle n|n-2,2\rangle$ type for the wave-function of four nucleons with j—j coupling (in nuclei), taking into account the isotopic spin. The normalized fractional parentage coefficients (for non-equivalent as well as equivalent particles) are expressed through the Hope χ-function, i.e. mainly in terms of the Wigner 9j-symbols. The results can be directly applied also in the case of atomic L—S coupling. A.

539.14

8260. CENTER-OF-MASS MOTION IN MANY-PARTICLE SYSTEMS. S.Gartenhaus and C.Schwartz.
Phys. Rev., Vol. 108, No. 2, 482-90 (Oct. 15, 1957).

An explicit construction is found for a unitary operator which insures the free motion of the centre of mass of any many-particle wave-function on which it is allowed to act. The transformation is used to calculate recoil correction terms for the internal energy and external interactions of nuclei, and some numerical evaluations are given for cases of interest. The many-body harmonic-oscillator problem is exactly soluble when one uses the transformation, and one is thus enabled to give a more general discussion of the spurious states. A.

539.14 : 539.17

TWO MODELS FOR THE NUCLEAR PHOTOEFFECT.
See Abstr. 7384

539.14 : 530.145

COLLECTIVE ROTATIONAL MOTION IN UNIFIED NUCLEAR MODEL. See Abstr. 7711

539.14

8261. WIGNER FORCES AND THE NUCLEAR SHELL MODEL. M.Bauer.
Rev. Mexicana Fís., Vol. 6, No. 3, 141-52 (July, 1957). In Spanish.

It is well known that velocity-dependent forces or exchange forces (which could also be considered as a type of velocity-dependent force), do not give the experimental level arrangement in nuclear shell theory. In particular, in the long-range approximation, both velocity-dependent forces and Majorana forces predict for configurations with an odd number of particles, that the ground state has an angular momentum J which is the lowest compatible with the Pauli principle, and not J = j, where j is the angular momentum of the nucleons in the shell. The purpose of this paper is to see whether for Wigner forces (i.e. forces with no exchange character), the level arrangement is the experimental one for any range. It is shown that for the two-particle configuration J = 0 will be the ground state independently of the range of the Wigner forces. For the three-particle configuration in the j = 5/2 shell, the ground state is J = 5/2, but already in the j = 7/2 shell, the ground state is J = 7/2 only in the short-range approximation. It is concluded therefore, that the experimental level arrangement is related with the short-range character of the nuclear forces, rather than with their velocity dependence or exchange character. A.

539.14

8262. NUCLEON ENERGY LEVELS IN SPHEROIDAL NUCLEI. D.A.Zaikin.
Zh. éksper. teor. Fiz., Vol. 33, No. 4(10), 1049-51 (1957). In Russian. English translation in: Soviet Physics — JETP (New York), Vol. 6, No. 4, 808-9 (April, 1958).

A method is given for solving the problem of energy levels in an ellipsoidal well which is valid for a finite well depth and for highly excited states. The case of a prolate spheroidal nucleus is considered. L.L.Green

539.14

8263. MEASUREMENT OF SPINS OF LEVELS EXCITED BY SLOW NEUTRON CAPTURE. J.D.Fox, R.L.Zimmerman, D.J.Hughes, H.Palevsky, M.K.Brussel and R.E.Chrien.
Phys. Rev., Vol. 110, No. 6, 1472-4 (June 15, 1958).

Single-channel analysed γ-rays from slow neutron capture in tungsten were detected as a function of the time-of-flight of the neutrons from a fast chopper. The highest bias detected ground-state γ-rays from W^{184} only. From the relative heights of the resonances with high and low bias, the spins of the resonance levels were deduced from known spins and the selection rules.

A.E.I. Research Laboratory

539.14 : 539.2

SPIN-LATTICE RELAXATION RESONANCES IN SOLIDS.
See Abstr. 7521

539.14 : 538.561

INVERSION OF NUCLEAR RESONANCE LINES.
See Abstr. 8159

539.14

8264. DETERMINATION OF NUCLEAR PARITIES AND SPINS BY APPLICATION OF BUTLER'S FORMULA.
F.Senent, E.Villar and A.Bonet.
An. Real Soc. Españ. Fís. Quím., Vol. 53(A), No. 5-6, 109-20 (May-June, 1957). In Spanish.

Angular distributions for $C^{12}(d,p)C^{13*}$ were obtained. Following Butler's theory of the stripping process, as a model for the (d,p) reactions, the authors calculated the theoretical angular distributions and found that the ground state of C^{13} has spin $\frac{1}{2}$ or $\frac{3}{2}$ and odd parity, while the 2.99 MeV excited state has spin $\frac{1}{2}$ and even parity. A.

539.14

8265. NUCLEAR ORIENTATION OF PRASEODYMIUM 142.
M.A.Grace, C.E.Johnson, R.G.Scurlock and R.T.Taylor.
Phil. Mag. (Eighth Ser.), Vol. 3, 456-60 (May, 1958).

By studying the anisotropy of the γ-radiation it was shown that both nuclear alignment and polarization of Pr^{142} can be obtained by cooling a single crystal of cerium magnesium nitrate in which the Pr is included. It was concluded that the nuclear moment of Pr^{142} is about 0.15 nuclear magneton and that the first excited state of Nd^{142} is of spin 2. M.A.Grace

539.14 : 535.332

QUADRUPOLE MOMENT OF I^{127}. See Abstr. 7803

539.14

8266. SPIN, PARITY, AND j—j EXPANSION COEFFICIENTS FOR STATES OF LOW EXCITATION IN O^{18}.
O.M.Bilaniuk and P.V.C.Hough.
Phys. Rev., Vol. 108, No. 2, 305-10 (Oct. 15, 1957).

A study of the angular distributions and of relative intensities of proton groups from the reaction $O^{17}(d,p)O^{18}$ has established even parity and total angular momenta of 0, 2, and 4 for the lowest three known states in O^{18}. These results, as well as the d-wave stripping intensities, are in remarkable agreement with theoretical predictions of Redlich and of Elliott and Flowers (Abstr. 9497/1954, 5585/1955). A mixed s-d angular distribution for the first excited state is shown to determine sensitively the coefficients of the $d_{5/2}s_{1/2}$ and $(d_{5/2})^2$ terms in a j—j expansion of the wave-function for this state. A.

539.14

8267. RADIATION WIDTHS OF LEVELS IN NUCLEI NEAR CLOSED SHELLS. A.Stolovy and J.A.Harvey.
Phys. Rev., Vol. 108, No. 2, 353-61 (Oct. 15, 1957).

An experimental investigation was made of the variations in the radiation widths of nuclear energy levels for isotopes in the regions of the neutron magic numbers, where fluctuations in level spacing and neutron binding energy are largest. Neutron transmission measurements were made using the Brookhaven fast chopper, and the Breit–Wigner level parameters were obtained for resonances in the following target isotopes: Sr^{87}, Sb^{121}, Sb^{123}, Ba^{135}, La^{139}, Nd^{145}, and Pt^{195}. Other elements around closed neutron shells namely, Rb, Zr, Nb, Ce, and Tl, were examined but no accurate measurements could be made of the radiation widths for these elements. Results show that the fluctuations in the measured radiation widths are small compared to the large fluctuations in neutron scattering widths, and that they are related to the level spacing and the effective level excitation energy. An effect arising from the closed shells at 82 and 126 neutrons is observed. Analysis of all the available "good" data indicates that the essential features of the theory of Blatt and Weisskopf are generally valid; that is, radiation widths are strongly dependent on the effective level excitation energy and weakly dependent on the level spacing. Experimental results are compared with predictions from semiempirical formulae. A.

539.14

8268. GAMMA-EMITTING STATES IN O^{16} BELOW 12 MeV. R.D.Bent and T.H.Kruse.
Phys. Rev., Vol. 108, No. 3, 802-9 (Nov. 1, 1957).

A study was made of states in O^{16} between 7.2 and 11.5 MeV excitation which belong to the sequence 0^-, 1^+, 2^-, 3^+, . . . (even angular momentum and odd parity, and vice versa). These states cannot break up into $C^{12} + \alpha$ but must decay by γ emission. The γ-rays from the F^{19} $(p,\alpha\gamma)O^{16}$ and $N^{15}(d,n\gamma)O^{16}$ reactions were studied at bombarding energies up to 6.0 and 5.08 MeV, respectively, using a three-crystal pair spectrometer and other scintillation counters. The design, resolution, and efficiency of the three-crystal pair spectrometer are given. The ground state transition from the 2^-, 8.87 MeV state was observed to have 0.07 ± 0.02 the intensity of the 2.73 MeV cascade transition to the 3^-, 6.14 MeV state. A state was found at 10.98 ± 0.04 MeV which decays predominantly to the 1^-, 7.12 MeV state. No γ-rays resulting from the decay of this state to other states of O^{16} were observed. The angular correlation of the 3.86 and 7.12 MeV γ-rays shows a positive anisotropy of approximately 1. These results suggest a 0^- spin and parity assignment for the 10.98 MeV state. The predictions of the alpha-particle and shell models of O^{16} are compared with these results. A.

539.14

8269. NEAR-HARMONIC STRUCTURE AND LEVEL SIMILARITIES IN Fe^{56}, Fe^{58} AND Ni^{60}. N.Levine, H.Frauenfelder and A.Rossi.
Z. Phys., Vol. 151, No. 3, 241-51 (1958).

In the case of Fe^{56}, no second 2^+ state with the desired energy or de-excitation characteristics had been reported by previous investigators and a search for a small excitation of such a level from the decay of Mn^{56} is described. The results are inconclusive, although some evidence for its existence is presented. This investigation of the Mn^{56}–Fe^{56} decay reveals the presence of an additional beta branch to a 2^+ level at 3.34 MeV in Fe^{56}. The results of the angular correlation measurements on the cascade gamma-rays from this and other levels are given. The stop-over transitions are found to be mostly M1 radiation and hence not of the near-harmonic type. In the case of Ni^{60}, the measured angular correlation functions for the 0.85-1.33 and 1.76-1.33 MeV cascades initiated from the decay of Cu^{60} are reported. For the former cascade, the results indicate that the stop-over transition is largely E2 radiation, but the experimental difficulties prevent a more quantitative statement. The presence of this type of radiation, together with a stop-over to cross-over intensity ratio of 15, imply the existence of near-harmonic structure in Ni^{60}. The angular correlation function for the latter cascade is found to be nearly identical to that of the corresponding cascade in Fe^{58} which lends weight to the contention that there exist level similarities in these nuclei. Additional evidence for these similarities is also presented. A.

539.14 : 539.17

8270. A NEW STUDY OF THE LOW LEVELS OF Be^8.
J.Catalá, R.Font, J.Aguilar, F.Senent and M.de la Cuadra.
An. Real Soc. Españ. Fis. Quím., Vol. 53(A), No. 11-12, 229-34 (Nov.-Dec., 1957). In Spanish.

The spectrum of the neutrons produced in the $Li^7(d,n)Be^8$ reaction was studied by means of nuclear plates. Levels of Be^8 were found at 1.37, 2.09, 2.81, 3.52, 4.20, 5.01, 5.91, 6.68 and 7.5 MeV. L.Pincherle

539.14

8271. STUDIES IN LITHIUM-7 AND NITROGEN-13. F.R.Haig.
Nuclear Phys., Vol. 7, No. 5, 429-42 (July [2], 1958).

The Pinkston–Brennan treatment of Li^6 and the Elliott treatment of N^{14} are tested by extending their assumptions to the respective three-body isotopes, Li^7 and N^{13}. The Li^7 analysis assigns a spin of 5/2 to the level at 4.61 MeV. The N^{13} analysis uses the Meshkov and Ufford tables for the expression of p^3 matrix elements in terms of p^2 elements. The phase conventions needed for the application to the $p^{-3} \rightarrow p^{-2}$ reduction are discussed. The results are favourable to Elliott's approach. A.

539.14

8272. EXCITED STATES IN Mn^{56}.
J.W.Green, A.J.Smith, W.W.Buechner and M.Mazari.
Phys. Rev., Vol. 108, No. 3, 841-3 (Nov. 1, 1957).

An electrostatic accelerator and a broad-range magnetic spectrograph were employed to investigate the excited states of Mn^{56} by means of the $Mn^{55}(d,p)Mn^{56}$ reaction. The proton groups from thin manganese targets were observed at 10, 30, and 60° with an incident deuteron energy of 7.0 MeV and at 20° with 6.6 MeV deuterons. In the region of excitation in Mn^{56} up to 7 MeV, 124 excited states were found. The ground-state Q-value for the reaction is 5.047 ± 0.005 MeV, and the first excited state is at 0.025 ± 0.004 MeV. A.

539.14

8273. POSITIONS AND WIDTHS OF O^{17} LEVELS FROM 4- TO 6-MeV EXCITATION. C.P.Browne.
Phys. Rev., Vol. 108, No. 4, 1007-14 (Nov. 15, 1957).

The $O^{16}(d,p)O^{17}$ reaction was used to measure the positions and widths of O^{17} levels from 4 to 6 MeV excitation. Proton spectra were obtained at high resolution with a broad-range spectrograph. This instrument accurately measured the widths and shapes of the energy distributions of the proton groups arising from the wider levels. Disagreements among other experiments concerning the O^{17} levels are explained in terms of the large difference in level widths. A comparison of these directly measured widths is made with those obtained from neutron scattering experiments. The observed shape of the energy distribution is that predicted by resonance theory. The 0.87 MeV level is found to be single rather than double, as recently suggested. Excitation energies obtained (in MeV) are 0.871 ± 0.004, 3.055 ± 0.004, 3.846 ± 0.005, 4.553 ± 0.006, 5.083 ± ± 0.010, 5.215 ± 0.005, 5.378 ± 0.007, 5.695 ± 0.005, 5.731 ± 0.005, 5.866 ± 0.005, 5.94 ± 0.015. Widths of levels 4, 5, 7 and 11 are (in keV) 40 ± 5, 95 ± 5, 28 ± 7, and 23 ± 10, respectively. The other levels have widths less than 8 keV. A.

539.14

8274. SPACINGS OF NUCLEAR ENERGY LEVELS.
J.A.Harvey and D.J.Hughes.
Phys. Rev., Vol. 109, No. 2, 471-9 (Jan. 15, 1958).

The distribution of spacings of nuclear energy levels in many heavy nuclei at an excitation energy of 5 to 9 MeV is obtained by careful correction of the observed distributions for the effect of failure to observe all levels. Results of transmission measurements on U^{234} and U^{236}, as measured with the Brookhaven fast chopper, are presented. The experimental spacings of the zero-spin nuclides are considered first since all the levels from slow neutron capture have the same spin. The results show a deficiency of small spacings relative to the exponential distribution, which corresponds to a random occurrence of levels. In the analysis it is shown that there is no local correlation of neutron widths and level spacings. The "level repulsion" effect is also found for the nuclides of non-zero spin, for which the data are more abundant but the analysis is complicated by the presence of two spin systems. The distribution obtained is in agreement with one suggested by Wigner based on a probability of level occurrence proportional to the spacing S. The corrections here developed are also applied to the reduced neutron width distribution and this correct distribution is in good agreement with the Porter–Thomas distribution (Abstr. 1619/1957). A.

539.14

8275. SINGLE CONFIGURATION ANALYSIS OF Li^6.
W.T.Pinkston and J.G.Brennan.
Phys. Rev., Vol. 109, No. 2, 499-504 (Jan. 15, 1958).

The energy level and static moment data of Li^6 are analysed in terms of the intermediate coupling model with the usual assumption

of a $(1s)^4 (1p)^2$ configuration. The matrix elements of the central, spin-orbit, and tensor forces are derived from the data. The potential implied by the data has a central force strength which is larger than that expected from the two-nucleon analysis and has a different spin dependence. The tensor part of the potential is found not to be necessary for a satisfactory energy-level structure, and an extremely weak tensor force is called for by the small quadrupole moment. The magnetic moment is too large by about 6%. An extensive numerical study was made of two-body potentials with parameters adjusted to give the correct binding energy and quadrupole moment to the deuteron and no simultaneous fit of the lithium energy levels and quadrupole moment seems possible. A.

539.14

8276. ENERGY LEVELS OF Be^9, C^{12}, AND C^{13}.
C.D.Moak, A.Galonsky, R.L.Traughber and C.M.Jones.
Phys. Rev., Vol. 110, No. 6, 1369-74 (June 15, 1958).

The reactions $Li^7(He^3,p)Be^9$, $B^{10}(He^3,p)C^{12}$, and $B^{11}(He^3,p)C^{13}$ were used to study the level structures of Be^9, C^{12} and C^{13}, respectively. Levels of Be^9 were observed at 1.83, 2.43, 3.1 and 4.8 MeV. Observations of the group corresponding to 1.83 MeV at different angles are consistent with the assumption of a level in Be^9 although a 3-body spectrum from $He^3 + Li^7 \rightarrow Be^8 + n + p$ could also fit the data. With the groups corresponding to the well-known C^{12} levels at 4.43, 7.65, 9.61 and 16.10 MeV used as calibrations, other levels were observed at 10.90, 11.84, 12.69, 13.30, 14.05, 14.97, 15.62 and 16.57 MeV. For the 7.65 MeV level $\Gamma_\gamma/\Gamma_\alpha < 1.4\%$ if the level emits a single γ-ray of 7.65 MeV, and $\Gamma_\gamma/\Gamma_\alpha < 0.9\%$ if there is a cascade through the 4.43 MeV state as it would if it were a 0^+ level. A proton group due to an α-particle level, predicted to lie at 5.53 MeV in C^{12}, was not found and must be more than 4000 times weaker than the proton group leading to the 4.43 MeV level. Rough estimates of $\Gamma_\gamma/\Gamma_\alpha$ for the 14.97 and 12.69 MeV levels are 50 ± 25% and 3 ± 1%, respectively. With the well-known C^{13} levels up to 6.87 MeV being used as calibrations, other levels were observed at 5.51, 6.10, 7.55, 8.87, 9.52 and 9.91 MeV. The levels at 5.51 and 6.10 MeV have not previously been detected. A.

539.14

8277. ENERGY LEVELS OF THE Dy^{161} NUCLEUS.
S.A.Baranov, Yu.F.Rodionov, G.V.Shishkin and L.V.Chistyakov.
Zh. éksper. teor. Fiz., Vol. 34, No. 6, 1367-80 (1958). In Russian.

The decay of beta-radioactive Tb^{161} was studied with aid of a double-focusing magnetic β-spectrometer, a spectrometric proportional counter and a scintillation spectrometer. The following γ-transitions in the Dy^{161} nucleus were established on basis of the measurements: 25.6 (E1), 25.8 (E1), 27.7, 42, 48.9 (M1), 52, 57.6, 74.5 (E1), 103.8, 131.5 keV and also less reliably established γ-transitions with energies E_γ equal to 20.4, 23.1, 46.3, 53.2, 57.0, 78.3, 84.0, 105.8 and ~275 keV. During investigation of the decay of Tb^{161} groups of β-particles were detected which possess the following end-point energies: E_{β_1} = 540 keV, E_{β_2} = 465 keV, E_{β_3} = 415 keV and E_{β_4} = 215 keV. A feasible energy-level scheme for the Dy^{161} nucleus is proposed on basis of the experimental results. A.

539.14 : 539.163.2

ENERGY LEVEL SCHEME OF W^{182}. See Abstr. 7335

539.14 : 539.17

Ne^{20} ENERGY LEVELS. See Abstr. 7364

539.14

8278. ESTIMATION OF THE LIFETIMES OF THE EXCITED STATES OF Hf^{178} AND Hf^{180}. V.V.Anisovich.
Zh. éksper. teor. Fiz., Vol. 34, No. 6, 1639-41 (1958). In Russian.

Following the ideas of Bohr and Nilsson (See Abstr. 4524/1952, 7638/1954, 3526/1957), lifetime estimates are obtained which are 30 to 40 times greater than those found experimentally.

W.O.Lock

539.14

8279. FORMATION OF Cd^{115} ISOMERS IN HIGH-ENERGY FISSION OF BISMUTH. N.T.Porile.
Phys. Rev., Vol. 108, No. 6, 1526-30 (Dec. 15, 1957).

The relative yields and recoil properties of the Cd^{115} isomers independently formed in the 450 MeV proton fission of bismuth were measured. The 43 day Cd^{115m} isomer has a higher yield and smaller range than the 53 hr Cd^{115}. Cd^{115m} is also formed in a higher deposition energy process than Cd^{115}. These results are explained in terms of the high spin states of the fission fragments resulting both from the high bombarding energy and from the fission act proper. A.

539.14

8280. TWO CASES OF HYPERFRAGMENT DECAYS.
Kh.P.Babayan, N.A.Marutyan, K.A.Matevosyan and M.G.Rostomyan.
Zh. éksper. teor. Fiz., Vol. 34, No. 1, 231-2 (1958). In Russian.

The first case is interpreted as the decay of either $F_\Lambda^{18,19,20}$ or $Ne_\Lambda^{20,21}$ with binding energy (18.9 ± 16.3) MeV for the former and (21.8 ± 17.7) MeV for the latter. The second case is the decay of either He_Λ^5 or $Li_\Lambda^{7,8}$. G.E.Brown

539.14

8281. HYPERFRAGMENTS IN NUCLEAR EMULSIONS.
B.P.Bannik, U.G.Gulyamov, D.K.Kopylova, A.A.Nomofilov, M.I. Podgoretskiĭ, B.G.Rakhimbaev and M.Usmanova.
Zh. éksper. teor. Fiz., Vol. 34, No. 2, 286-97 (1958). In Russian.

The properties and relative frequency of appearance of hyperfragments were investigated. Some phenomena produced by other types of unstable heavy particles are also mentioned. A.

539.14 : 621.373.4

8282. MODULATION PICKUP IN NUCLEAR MAGNETIC RESONANCE R.F. SPECTROMETERS.
G.B.Robinson and F.E.Geiger, Jr.
Rev. sci. Instrum., Vol. 29, No. 8, 730-1 (Aug., 1958).

R.F. oscillators used as detectors of nuclear paramagnetic resonance absorption employ an auxiliary source at audio frequency to modulate the static magnetic field. A small component of voltage at this frequency is usually induced into the tank coil of the oscillator. If this voltage is permitted to appear at the grid of the oscillator, mixing with the r.f. voltage will occur. This produces a false signal indistinguishable from the resonance signal. A simple LC filter put between tank circuit and oscillator tube is found to be extremely effective in removing false resonances. The response of the oscillator to signals generated by a Watkins calibrator is measured in the range from 5 to 25 Mc/s. Results of these and "Q" measurements show the oscillator sensitivity to be unimpaired by the addition of the LC network. A.

539.14

8283. NON-STATIONARY PHENOMENA IN NUCLEAR MAGNETIC RESONANCE. V.S.Grechishkin.
Zh. éksper. teor. Fiz., Vol. 34, No. 4, 902-7 (1958). In Russian.

"Vibration" of a nuclear spin system induced by a single triangular pulse is considered. Transition processes due to frequency jumps which model the "beating of beats" phenomena are computed. It is demonstrated that a transition process in a spin system is determined only by the properties of the latter, but not by the form of the radio-frequency field. Formulae are obtained which can be employed to measure relaxation periods. A.

RADIOACTIVITY

539.16.08 : 539.17

SCINTILLATION-COUNTER ANALYSIS OF E.B.W.R. RADIOACTIVITY. See Abstr. 7408

539.163

8284. MEASUREMENTS OF RADON AND THORON DECAY PRODUCTS IN THE AIR BY THE FILTER METHOD. T.L.Cullen.
An. Acad. Brasil. Ciênc., Vol. 29, No. 4, 545-52 (1957).

Methods of measuring radon and thoron in air are briefly reviewed. The measurement is discussed of the beta activities of their decay products collected on filters. Assuming typical concentrations of 10^{-16} curies Rn/cm^3 of air and 10^{-17} curies Tn/cm^3 of air, the number of atoms per cm^3 for radon, thoron and their daughter products are calculated. From equations for the rate of deposition, it is shown that radon decay products reach equilibrium activity after four hours collection, whereas for thoron decay products, equilibrium activity has not been reached after 40 hr collection. Equations for the total beta-decay rate, after collection has ceased, are given; the effect of time of collection is discussed and illustrative graphs are presented. Using a calibrated beta counter, a proposed method to determine the individual activities of the five beta emitters is described.

A.E.I. Research Laboratory

539.163

8285. RADIOACTIVITY OF In^{120} AND Sb^{120}. C.L.McGinnis.
Phys. Rev., Vol. 109, No. 3, 888-90 (Feb. 1, 1958).

An investigation of the radiations from the mass-120 isobars was made using magnetic lens, scintillation pulse-height, and coincidence counting techniques. Sb^{120m} decays with a 5.8-day

half-life by electron capture, positron emission if any < 0.03%, to an 11 μsec level of Sn^{120}, which then decays by the emission of the following gamma rays (energies in MeV): 0.089 (E1), 0.199 (E2), 1.04 (E2), and 1.18 (E2). The 1.18 MeV gamma-ray also occurs in the decay of the 16 min Sb^{120}, where the number of gamma rays per positron is 0.03. An activity of ~ 55 sec is assigned to In^{120m}. A decay scheme is proposed. A.

539.163.1

8286. THE HALF-LIFE OF Na^{24}. P.J.Campion and J.S.Merritt.
Canad. J. Phys., Vol. 36, No. 7, 983-6 (July, 1958).

Sources of Na^{24} were purified by an ion exchange separation and their decay was followed by 4π β-counting. A value of 14.959 ± ± 0.010 hr for the half-life was obtained. M.A.Grace

539.163.1

8287. NEW 20-HOUR ELECTRON-CAPTURING RHENIUM ISOTOPE, Re^{181}. C.J.Gallagher, Jr, M.Sweeney and J.O.Rasmussen.
Phys. Rev., Vol. 108, No. 1, 108-10 (Oct. 1, 1957).

A new 20 ± 2 hr electron-capturing rhenium isotope was investigated. A mass assignment to Re^{181} is made from the energy threshold for its production by alpha-particle bombardment of Ta^{181} and by the chemical separation and identification of its radioactive daughter, W^{181}. A very prominent 365.5 keV transition is observed in the gamma-ray and electron spectra. It is deduced from the 365.5 keV gamma to K X-ray intensity ratio that more than 80% of the electron capture populates the level at 365.5 ± 0.2 keV above the ground state. This level apparently decays directly to ground by a delayed M2 transition, and is believed to be the same 14 μsec isomer observed by others from a (γ,n) reaction on W^{182}. A possible interpretation of the 365.5 keV transition in terms of the odd-neutron states of a spheroidal well is given. A.

539.163.1

8288. PRECISION MEASUREMENTS OF THE HALF-LIVES OF THE POSITON EMITTERS ^{25}Al, $^{26}Al^m$, AND ^{33}Cl.
T.Muller, E.S.Gelsema and P.M.Endt.
Physica, Vol. 24, No. 7, 577 83 (July, 1958).

The half-lives of the positron emitters Al^{25}, Al^{26m}, and Cl^{33}, produced by (p,γ) reactions at selected resonances, were measured by means of two different methods: (a) with a 70-channel pulse-analyser using time-to-pulse-height conversion; (b) with an eleven-contact stepping switch and eleven sets of scales and mechanical registers. The results are:

Al^{25} 7.24 ± 0.03 sec;
Al^{26m} 6.28 ± 0.04 sec;
Cl^{33} 2.53 ± 0.02 sec. A.

539.163.2

8289. THE DECAY OF Os^{185}.
M.W.Johns, S.V.Nablo and W.J.King.
Canad. J. Phys., Vol. 35, No. 10, 1159-75 (Oct., 1957).

A study of the decay of Os^{185} with a magnetic beta-ray spectrometer, scintillation counters, and coincidence circuits reveals radiations of the following energies (in MeV), intensities, and multipolarities: K-shell X-rays (65%), 0.0716 (0.4%, M1 + E2), 0.1255 (2.5%, M1 + E2), 0.1626 (1%, M1), 0.2334 (1.4%, E2), 0.5920 (1.1%, E2), 0.6458 (80%, E2), 0.7177 (4.1%, M1 + E2), 0.8720 (7.1%, M1+ E2), and 0.8789 (7.5%, M1 + E2). These transitions are interpreted in terms of a decay scheme involving the following levels in Re^{185}: 0 (5/2+), 0.1255 (7/2+), 0.6458 (1/2+), 0.7176 (3/2+), 0.872 (3/2+), and 0.879 (3/2+) MeV. The ratio of L-capture to K-capture considering decay to all levels of Re^{185} is 0.38 ± 0.07. The ratio of L-capture to K-capture to the 0.872 and 0.879 MeV levels is 1.04 ± 0.04. This implies that the Os^{185}-Re^{185} atomic energy difference is 0.985 ± 0.007 MeV. The half-life of Os^{185} was found to be 93.6 ± 0.5 days. A.

539.163.2

8290. NOTE ON THE DECAY OF ^{82}Sr. V.Sangiust.
Nuovo Cimento, Vol. 9, No. 3, 446-50 (Aug. 1, 1958).

Gamma and X radiation accompanying the decay of Sr^{82} were investigated. Gamma-rays of 775 and 1400 keV were found; Rb^{82} daughter of Sr^{82}, is shown to decay through β^+ emission, not only to the ground state but also to excited levels of Kr^{82}. A.

539.163.2

8291. TRANSITION IN 26-MIN U^{238m} OF LESS THAN 13 ELECTRON VOLTS.
M.S.Freedman, F.T.Porter, F.Wagner, Jr and P.P.Day.
Phys. Rev., Vol. 108, No. 3, 836-41 (Nov. 1, 1957).

The conversion-electron spectrum from the decay of 26 min U^{238m} was examined by both magnetic spectrometry employing pre-acceleration and by electrostatic spectrometry. The energy distribution is peaked at 0.5 eV with evidence of structure at 5 eV and at 19 eV, leading to an estimated upper limit of 23 eV for the transition energy. Tests of the performance of the apparatus were made with the conversion spectrum of the low-energy transition in 6 hr Tc^{99m}, redetermined as 2.15 eV; with the "zero energy" peak of Am^{241} and with the spectrum of photoelectrons excited from silver with ultraviolet light. A.

539.163.2

8292. BREAKUP OF Be^{9*} (2.43 MeV).
D.Bodansky, S.F.Eccles and L.Halpern.
Phys. Rev., Vol. 108, No. 4, 1019-24 (Nov. 15, 1957).

The level was excited by inelastic scattering of 42 MeV alpha particles and the break-up was studied by examining coincidences between inelastically scattered alpha particles and particles from the break-up. It was found that decay from this state proceeds less than 10% of the time by neutron emission to the ground state of Be^8 and less than 1% of the time by gamma emission to the ground state of Be^9. The low neutron-emission probability is consistent with the usual 5/2− spin-parity assignment for this state. A.

539.164.08 : 538.311.33

GERMANIUM N–P ALPHA-PARTICLE COUNTERS AT LOW TEMPERATURES. See Abstr. 7965

539.165/.166 : 539.14

8293. EXCITED STATES OF Dy^{161}. C.W.McCutchen.
Phys. Rev., Vol. 109, No. 4, 1211-16 (Feb. 15, 1958).

The γ-rays following the β-decay of Tb^{161} were investigated with sodium iodide scintillation counters and with a xenon counter used with and without an X-ray escape gating. Gamma-rays of 74, 57, 49 and 26 keV were observed together with Dy X-rays. From these data and γ, K X-ray coincidence measurements, rough estimates are obtained for the K conversion coefficients of the 74 and 57 keV transitions. Combination of the γ-ray intensities with conversion-electron intensities determined by Cork, Brice, Schmid and Helmer (Abstr. 2586/1957) yields K and L conversion coefficients for all the transitions once the normalization of conversion electron and γ-ray intensities has been assumed. Where comparison is possible these conversion coefficients agree with those determined from the X-ray and γ-ray measurements alone. The multipolarities seem largely compatible with the unified-model predictions of Nilsson. There is a possibility of at least one highly retarded E1 transition. A.

539.165

8294. AVERAGE ENERGY OF SULFUR-35 BETA DECAY.
H.H.Seliger, W.B.Mann and L.M.Cavallo.
J. Res. Nat. Bur. Stand., Vol. 60, No. 5, 447-50 (May, 1958).

The rate of energy emission in an approximately 400 millicurie source of S^{35} was measured by means of a "radiation-balance" microcalorimeter. This value and the disintegration rate of an accurate dilution of the sample measured by means of 4πβ-gas-proportional counting yield a mean energy for S^{35} beta-decay of 50.4 $(^{+0.7}_{-1.2})$ keV. The half-life was found to be 87.16 ± 0.1 days. A.

539.165

8295. DETERMINATION OF ELECTRON POLARIZATION BY ELECTRON–ELECTRON SCATTERING: Y^{90} AND Au^{198}.
N.Benczer-Koller, A.Schwarzschild, J.B.Vise and C.S.Wu.
Phys. Rev., Vol. 109, No. 1, 85-9 (Jan. 1, 1958).

The polarization of the β-particles from Y^{90} and Au^{198} was investigated by using electron–electron scattering. The reliability of this method and the precautions necessary in its application are discussed. It was found that for both Y^{90} and Au^{198} the polarization is (−v/c). A.

539.165.2

8296. PARITY NON-CONSERVATION AND TRANSVERSE POLARIZATION OF β-PARTICLES: ADDED REMARKS.
G.Györgyi and H.Überall.
Nuclear Phys., Vol. 6, No. 3, 539-40 (April, 1958).

It is pointed out that the transverse polarization discussed in an earlier paper (Abstr. 6259/1958) can be useful for a determination of the handedness of the neutrino; the observation of the nuclear recoil, which is necessary, may be done by Goldhaber's method (Abstr. 2461/1958). Certain errors in the earlier paper are rectified. P.K.Kabir

539.165.2

8297. β-DECAY OF N^{13} AND FIERZ INTERFERENCE ON FERMI INTERACTION. H.Daniel and U.Schmidt-Rohr.
Nuclear Phys., Vol. 7, No. 5, 516-25 (July [2], 1958). In German.

The β-ray spectrum of the mirror transition $N^{13} \rightarrow C^{13}$ was investigated with an iron-free lens spectrometer. No deviation from the allowed shape was observed. The Fierz coefficient was measured to be b = (0.14 ± 2.37)% (standard deviation). Taking into account that only 70% of the transition rate are due to Fermi interaction an upper limit of 11% is found for $|b_F|$, b_F being the Fierz coefficient for pure Fermi interaction. A.

539.165.2 : 539.12

8298. POSITRON POLARIZATION IN A MIRROR TRANSITION. F.Boehm, T.B.Novey, C.A.Barnes and B.Stech.
Phys. Rev., Vol. 108, No. 6, 1497-9 (Dec. 15, 1957).

The positron polarization in the mirror transition N^{13}, a predominantly Fermi transition, was measured by detecting the circular polarization of the annihilation-in-flight quanta. The results indicate complete polarization of the positrons parallel to their momentum, showing that Fermi coupling contributes significantly to the positron polarization in the same sense as the Gamow–Teller coupling. A.

539.165.2 : 539.12

8299. POLARIZATION OF POSITRONS FROM Ga^{66}, Ga^{68}, P^{29}, AND Al^{25}. R.S.Preston and S.S.Hanna.
Phys. Rev., Vol. 110, No. 6, 1406-8 (June 15, 1958).

The longitudinal polarizations of thermalized positrons were observed from measurements on annihilation with polarized electrons in a magnetic medium. When allowance is made for the depolarization suffered by the positrons in coming to rest, the observations are in qualitative agreement with the assumption that the initial polarizations are proportional to +v/c with the same proportionality constant as for positrons from Cu^{64}. A.

539.165.2

8300. DETERMINATION OF THE GAMOW–TELLER BETA-DECAY INTERACTION FROM THE DECAY OF HELIUM-6. W.B.Herrmannsfeldt, R.L.Burman, P.Stahelin, J.S.Allen and T.H.Braid.
Phys. Rev. Letters, Vol. 1, No. 2, 61-3 (July 15, 1958).

The electron–neutrino angular correlation coefficient was measured for the β-decay of He^6 using the apparatus which had previously been used to measure the angular correlations in the positron decays of A^{35} and Ne^{19} (Abstr. 9856/1957). An experimental value of $\lambda = -0.39 \pm 0.02$ is reported for the angular correlation coefficient indicating that axial-vector interaction, for which $\lambda = -1/3$, is dominant. L.L.Green

539.166 : 539.14

8301. GAMMA RADIATION FOLLOWING THE DECAY OF Mn^{56} AND THE ENERGY LEVELS OF Fe^{56}. C.S.Cook.
Nuclear Phys., Vol. 7, No. 5, 480-7 (July [2], 1958).

The gamma-radiation following the decay of Mn^{56} was studied using a 4" diameter by 4" high NaI:Tl crystal spectrometer. Two new gamma-rays at 2.52 and 3.39 MeV were found. Relative intensities of the gamma-rays are reported. A.

539.166 : 539.14

8302. RELATIVE TRANSITION PROBABILITIES IN CERTAIN EVEN NUCLEI. C.F.Coleman.
Nuclear Phys., Vol. 7, No. 5, 488-502 (July [2], 1958).

Angular correlation measurements on 2, 2, 0 cascades in Se^{76}, Ge^{72}, Zr^{92} and Te^{122} are reported. An analysis of the available data on such cascades shows that in non-rotational even nuclei the M1 transition probability from the second to the first excited state and the E2 crossover transition probability are inhibited by factors of about 10^4 and 10^2 respectively in relation to the E2 transition probability from the second to the first excited state. For the magic nuclei Zr^{92} and Ce^{140} the corresponding factors are both less than or of the order of unity. A.

539.166

8303. GAMMA RADIATION FROM N^{14} + d AND C^{13} + d. W.A.Ranken, T.W.Bonner, J.M.McCrary and T.A.Rabson.
Phys. Rev., Vol. 109, No. 3, 917-21 (Feb. 1, 1958).

A magnetic-lens pair spectrometer with 2.5% resolution was used to study radiations produced by the bombardment of N^{14} and C^{13} by deuterons from a Van de Graaff accelerator. Gamma-rays from the bombardment of N^{14} with 4.5 MeV deuterons were observed with quantum energies of 8.321 ± 0.020, 9.07 ± 0.04, 10.03 ± 0.04, and 10.81 ± 0.04 MeV. The detection of radiation from the 10.81 MeV level of N^{15}, in competition with proton emission, indicates a small proton width for this level, and an argument is advanced for the assignment of spin and parity values of $\frac{3}{2}^+$ to this state. Gamma-rays from the bombardment of C^{13} with 4.5 MeV deuterons were observed with energies of 4.897 ± 0.025, 5.102 ± 0.025, 5.669 ± 0.025, 5.833 ± 0.030 (not Doppler-corrected), 6.090 ± 0.020, 6.419 ± 0.030, 6.700 ± 0.025, 7.012 ± 0.025, and 7.323 ± 0.025 MeV. Experiments were performed which indicate conclusively that the 4.46 MeV γ-ray from the bombardment of C^{13} by deuterons is from B^{11}. All γ-ray energies listed were corrected for Doppler shift except where indicated. A.

539.166 : 539.14

8304. GAMMA RAYS FROM C^{13} + d AND THE EXCITED STATES OF C^{14}. E.K.Warburton and H.J.Rose.
Phys. Rev., Vol. 109, No. 4, 1199-210 (Feb. 15, 1958).

A study was made of the γ-rays produced by the bombardment of C^{13} by deuterons from the Brookhaven Van de Graaff accelerator with particular emphasis on the γ-rays from the $C^{13}(d,p)C^{14}$ reaction. A search for C^{14} γ-emitting states and cascade transitions was made using a three-crystal pair spectrometer and other scintillation counters at bombarding energies up to 3.7 MeV. From coincidence measurements the assignment of the 0.81 MeV γ-ray to the cascade transition between C^{14} 6.89 and 6.09 MeV states was confirmed and a previously unreported 0.62 MeV γ-ray was assigned to the cascade transition between C^{14} 7.35 and 6.72 MeV states. Limits on the lifetimes of the C^{14} 6.89, 6.72, and 6.1 MeV states were obtained from measurements of the Doppler shifts of the 0.81, 6.72, and 6.1 MeV γ-rays. The lifetime limit for the 6.72 MeV state was combined with previous measurements to give a most probable assignment of $J^\pi = 3^-$ for the 6.72 MeV state, while the lifetime limit for the C^{14} 6.89 MeV state showed that the 0.81 MeV transition is chiefly dipole. Measurements of the angular correlation of the 0.81 and 6.1 MeV γ-rays were interpreted by expressing the angular correlation functions in terms of the relative populations of the magnetic substates of the C^{14} 6.89 MeV state. By this method an assignment of J = 0 was obtained for the C^{14} 6.89 MeV state. A.

539.166 : 539.17

8305. GAMMA-RAY SPECTRA FROM NEUTRON CAPTURE IN RESONANCES OF Mn^{55}.
T.J.Kennett, L.M.Bollinger and R.T.Carpenter.
Phys. Rev. Letters, Vol. 1, No. 2, 76-7 (July 15, 1958).

A fast chopper selected neutrons of energy corresponding to resonances in Mn^{55}, and a fast-slow system was used to examine those low energy γ-rays detected in one scintillator in coincidence with a high energy band of γ-rays selected from another scintillator. This is equivalent to observing the high energy γ-rays with an effective resolution much greater than is possible by direct observation, enabling partial γ-ray widths to be assigned for transitions from highly excited compound states to the first few excited states. Markedly different intensities arise from the different resonances even where the compound nucleus has the same spin state in two cases, indicating that the reduced radiative widths may not be constant, but may vary statistically. Further extensive studies are in progress. A.E.I. Research Laboratory

539.166 : 539.164

8306. ON THE γ- AND α-DECAY OF EXCITED STATES OF $^{130}_{84}Po^{214}$(RaC')*. U.Hauser.
Z. Phys., Vol. 150, No. 5, 599-613 (1958). In German.

The normalized absolute γ-transition probabilities for several excited states of Po^{214}(RaC') are calculated with the help of the theory of α-decay and the theory of multipole transitions, and used to determine the spins and parities of these levels. From this, a term scheme for Po^{214}(RaC') is proposed which yields a complete classification of the 13 α-groups found by Rutherford in the decay-scheme Po^{214}(RaC') $\overset{\alpha}{\rightarrow}$ Pb^{210}(RaD). The calculated normalized γ-transition probabilities agree surprisingly well with each other and with the expected values. The α-emitting levels may be arranged in equidistant groups, which appear to satisfy a relation of the form $E = E_0 + nD$ very accurately. This cannot be directly interpreted as a consequence of a collective motion of the nucleus. P.K.Kabir

539.166.83

8307. THE 97 keV TRANSITION IN THE DECAY OF GADOLINIUM-153. M.C.Joshi and B.N.Subba Rao.
Proc. Indian Acad. Sci. A, Vol. 46, No. 6, 430-2 (Dec., 1957).

The decay was studied by means of internal conversion and external conversion data, using a Siegbahn–Slätis intermediate-image beta-ray spectrometer. The existence of the 96 ± 2 keV

transition in Gd^{153} was established and its conversion coefficient determined. A.

539.166.83

8308. CONVERSION OF LII AND LIII ELECTRONS WITH EMISSION OF E1 QUANTUM IN E0 NUCLEAR TRANSITIONS. D.P.Grechukhin.
Zh. éksper. teor. Fiz., Vol. 33, No. 4(10), 1037-8 (1957). In Russian.
English translation in: Soviet Physics — JETP (New York), Vol. 6, No. 4, 797-8 (April, 1958).

The process is considered in which LII or LIII electrons first emit an E1 quantum, changing to a state with momentum $j = 1/2$, $l = 0$, and then convert in an E0 nuclear transition. The probability $W_{\gamma E0}$ for this process is compared theoretically with the probability W_{E0} for direct conversion and it is found that the ratio $W_{E0}/W_{\gamma E0}$ can be of the order of unity for LII electrons, whereas for LIII electrons $W_{E0}/W_{\gamma E0}$ is always less than 10^{-4} to 10^{-5}. A.E.I.Research Laboratory

NUCLEAR REACTIONS

539.17

8309. NUCLEAR INVESTIGATIONS IN VALENCIA. J.Catalá de Alemany.
An. Real Soc. Espan. Fís. Quím., Vol. 53(A), No. 1-2, 5-30 (Jan.-Feb., 1957). In Spanish.

A short account of nuclear research carried out by the photographic method during the years 1950-56 in the Physics Laboratory of the University of Valencia. A.

539.17

8310. ENERGY DEPENDENCE OF CROSS SECTIONS NEAR THRESHOLD: ONE NEUTRAL AND TWO CHARGED REACTION PRODUCTS. R.W.Hart, E.P.Gray and W.H.Guier.
Phys. Rev., Vol. 108, No. 6, 1512-22 (Dec. 15, 1957).

The energy dependence near threshold of cross-sections for reactions leading to the escape of one neutral and two charged particles is determined. The method is an extension of one developed previously for uncharged particles (Abstr. 5609/1957), and utilizes only general properties of solutions of the time-independent three-particle Schrödinger equation valid outside a reaction zone of finite extent. Electron detachment from H^- by charged particle bombardment, and nuclear reactions of the type (n,np) are considered as examples. A.

539.17

8311. ON THE RELATIONSHIP BETWEEN THE ANGULAR AND ENERGY DISTRIBUTIONS OF PARTICLES EMITTED IN HIGH-ENERGY NUCLEAR INTERACTIONS. G.B.Zhdanov.
Zh. éksper. teor. Fiz., Vol. 34, No. 4, 856-61 (1958). In Russian.

In continuation of earlier work (Abstr. 4101/1957) various experimental data on the magnitude of the transverse component of the momentum of particles created in high-energy nuclear interactions are considered. The data are compared with the one-dimensional hydrodynamical theory of multiple particle production. A.

539.17

8312. RELATIVISTIC THEORY OF REACTIONS INVOLVING POLARIZED PARTICLES. Chzhou Guan-chzhao and M.I.Shirokov.
Zh. éksper. teor. Fiz., Vol. 34, No. 5, 1230-9 (1958). In Russian.

It is shown that the relativistic formulae for the angular distribution, polarization vectors and tensors of reactions of the $a + b \rightarrow c + d$ type in the rest system are essentially the same as the non-relativistic formulae, if the particle spin is defined as the internal angular momentum of the particle with respect to its centre of mass. The square of this intrinsic angular momentum is a Lorentz invariant. The particle spins are arbitrary, their rest masses are not equal to zero. The main difference from the non-relativistic case is that the description of the spin state is not the same in different Lorentz systems. Therefore for cascade reactions (such as in experiments on double scattering) corrections must be introduced in the non-relativistic formal theory. The relativistic modifications in the angular correlations for cascades of the type $\pi + p \rightarrow Y + KY \rightarrow N + \pi$ are indicated. A.

539.17

NUCLEAR REACTIONS DUE TO COSMIC RAYS. See also under "Cosmic rays". Decimal classification 537.591.8

539.17

8313. DEPTH VARIATION OF TRITIUM AND ARGON-37 PRODUCED BY HIGH-ENERGY PROTONS IN IRON. E.L.Fireman and J.Zähringer.
Phys. Rev., Vol. 107, No. 6, 1695-8 (Sept. 15, 1957).

The H^3 produced by 0.16, 1.0, 3.0, and 6.2 BeV protons and the A^{37} by 0.16, 1.0, and 6.2 BeV protons in long iron targets is measured as a function of depth. The maximum effective H^3 cross-section is 7.2 millibarns at 0.16 BeV, 60 millibarns at 1.0 BeV, 100 millibarns at 3.0 BeV, and 130 millibarns at 6.2 BeV. The maximum effective A^{37} cross-section is 0.19 millibarns at 0.16 BeV, 4.7 millibarns at 1.0 BeV and 6.7 millibarns at 6.2 BeV. The depth variation of these isotopes is very energy-dependent. At the higher energies a slight transition effect occurs. At the lower energies there is an exponential decrease with depth. The comparison of these measurements with the depth variation of He^3 in the Carbo meteorite shows that the cosmic rays that produced the He^3 in this material were very similar to the protons with 6 BeV energy. The H^3 to A^{37} ratio is not very energy- or depth-dependent. The ratio is 15 at 1 BeV and 20 at 6.2 BeV. However, for 0.16 BeV protons the H^3 to A^{37} ratio increases from 40 to 1000 in 4 cm depth. The H^3 to A^{37} ratio is compared with the He^3 to A^{36} ratio in four iron meteorites. These are comparable to a remarkable extent with the BeV proton results. The small variation of the He^3 to A^{36} ratio in meteorites is related to the fact that the H^3 to A^{37} ratio is not very energy- or depth-sensitive for protons in the BeV range; however, the He^3 to A^{36} ratio also favours the 6 BeV energy. A.

539.17

8314. GAMMA RAYS FROM THE REACTIONS $F^{19}(p,\alpha\gamma)O^{16}$, $Be^9(d,p\gamma)Be^{10}$, $Be^9(d,n\gamma)B^{10}$, $B^{10}(p,p'\gamma)B^{10}$, AND $B^{11}(p,p'\gamma)B^{11}$. J.H.McCrary, T.W.Bonner and W.A.Ranken.
Phys. Rev., Vol. 108, No. 2, 392-7 (Oct. 15, 1957).

A magnetic-lens pair spectrometer was used to detect γ-radiation from the $F^{19}(p,\alpha)O^{16*}$ reaction. The γ-ray transition from the 8.88 MeV level in O^{16} to the ground state and the cascade γ from this level to the 6.13 MeV state were observed. Relative intensities of these γ-rays and the 7.12 MeV γ-ray are given. Gamma-ray spectra from $Be^9 + d$ were observed at 1.5, 2.0, 3.2, and 4.0 MeV deuteron energies. Relative intensities of the 2.90, 3.38, 4.45, and 5.99 MeV γ-radiation were determined. Excitation curves were obtained for the 3.38 and 5.99 MeV γ-rays from Be^{10*} between deuteron energies of 1.0 and 5.6 MeV. The relative intensities of the 3.58, and 2.86 MeV radiations from the 3.58 MeV level in B^{10*} were measured using the $B^{10}(p,p')B^{10*}$ reaction. Other γ-radiation with energies of 0.43 MeV from $B^{10}(p,\alpha)Be^{7*}$, 0.72, 1.023, and 1.438 MeV from $B^{10}(p,p')B^{10*}$, and 2.134 MeV from $B^{11}(p,p')B^{11*}$ was observed. A.

539.17

8315. TRANSMUTATION OF NITROGEN BY PROTONS FROM 100 keV TO 135 keV. W.A.S.Lamb and R.E.Hester.
Phys. Rev., Vol. 108, No. 5, 1304-7 (Dec. 1, 1957).

A portion of the excitation curve of the thermonuclear reaction $N^{14}(p,\gamma)O^{15}$ was measured using protons of 100 to 135 keV. The cross-section of this reaction ranges from $(8.5 \pm 3.7) \times 10^{-13}$ barn at 100 keV to $(1.4 \pm 0.3) \times 10^{-10}$ barn at 135 keV. The approximate constant S_0 is defined by $S_0 = E\sigma \exp(31.281 Z_p Z_n A^{1/2} E^{-1/2})$, where E is the energy in the centre-of-mass system and is measured in keV, σ is in barns, A is the reduced mass of the interacting nuclei, and Z_p and Z_n are the nuclear number of protons and nitrogen, respectively. Based upon these measurements, $S_0 = 2.7 \pm 0.2$ keV barn. A.

539.17

8316. RADIATIVE PROTON CAPTURE BY Ni^{58}, Ni^{60}, AND Co^{59}. J.W.Butler and C.R.Gossett.
Phys. Rev., Vol. 108, No. 6, 1473-95 (Dec. 15, 1957).

Thin targets of Ni^{58}, Ni^{60}, and Co^{59} were bombarded with protons from 700 to 1900 keV. Seventeen radiative capture resonances were observed for Ni^{58}; fifty-four resonances were observed for Ni^{60}; and about 150 resonances were observed for Co^{59}. Precise bombarding energies were determined for the nickel resonances, and are listed in tabular form. All resonances were narrower than 1 keV. The $\int\sigma(E)dE$ was measured for each of the nickel resonances. The following Q values were determined: $Ni^{58}(p,\gamma)Cu^{59}$, 3.42 ± 0.02 MeV; $Ni^{60}(p,\gamma)Cu^{61}$, 4.81 ± 0.03 MeV. The following low-energy cascade gamma-rays were observed: Ni^{58}, 0.492 ± 0.005, 0.908 ± 0.020, 1.38 ± 0.03, 1.78 ± 0.02, 2.00 ± 0.04, and 2.32 ± 0.04 MeV; Ni^{60}, 0.468 ± 0.010, 0.96 ± 0.02, 1.30 ± 0.02, 1.38 ± 0.02, 1.63 ± 0.03, and 1.91 ± 0.03 MeV; Co^{59}, 0.47 ± 0.02, 0.84 ± 0.02, 0.95 ± 0.02, 1.07 ± 0.02, 1.17 ± 0.02, 1.33 ± 0.02, 1.64 ± 0.03, and 1.77 ± 0.03 Me

Branching ratios to all states below 2 MeV were measured from several of the intense resonances in the nickel isotopes. The branching ratio measurements indicated that the low-energy member of each cascade in the nickel reactions, except possibly the 1.30 MeV gamma-ray from protons on Ni^{60}, represented an excited state of the same energy; but indications for a 1.38 MeV state in Cu^{59} and a 1.63 MeV state in Cu^{61} were weak. Angular distribution measurements were made on some of the more intense resonances in the nickel isotopes, and unique spins were determined for those resonant states and for the first excited state of Cu^{59}. For the states whose spins were measured, probable parity assignments are made. Reduced proton widths were determined for the resonances below a bombarding energy of 1300 keV. The matrix elements for the several E1 and M1 transitions are compared with previous tabulations. Several new experimental techniques are discussed. A.

539.17 : 539.12

REACTION $p + p \rightarrow \pi^+ + d$ IN THE 425 MeV ENERGY REGION.
See Abstr. 8242

539.17

8317. INELASTIC SCATTERING OF 96 MeV PROTONS.
K.Nishimura.
Nuclear Phys., Vol. 7, No. 5, 425-8 (July [2], 1958).

An analysis is made of the angular distribution of 96 MeV protons inelastically scattered by carbon. It was found that by using the collective model of the nucleus the agreement with experimental results is as good as in the previous calculations based upon the individual particle model of the nucleus. A.

539.17

8318. ANALYSIS OF ELASTIC SCATTERING AND POLARIZATION OF 300 MeV PROTONS.
F.Bjorklund, I.Blandford and S.Fernbach.
Phys. Rev., Vol. 108, No. 3, 795-9 (Nov. 1, 1957).

Optical-model calculations were carried out on an I.B.M.-704 computer for 300 MeV protons incident on various nuclei. Both differential cross-sections and polarization curves were obtained and compared with existing experimental data. A.

539.17

8319. ANTIPROTON–HYDROGEN SCATTERING AND INELASTIC SCATTERING FROM COMPLEX NUCLEI.
G.Goldhaber, T.Kalogeropoulos and R.Silberberg.
Phys. Rev., Vol. 110, No. 6, 1474-6 (June 15, 1958).

In following 38 metres of antiproton track to rest in nuclear emulsions, in addition to 196 annihilations in flight and 217 at rest, the authors found 10 antiproton–hydrogen elastic scatterings and 9 inelastic nuclear scatterings. The forward-to-backward ratio of $\bar{p}$–H scatterings is 9 : 1, in agreement with the predictions of the theory of Ball and Chew. The observed cross-section for this process is $71\ ^{+30}_{-21}$ mb. Amongst the annihilation events, at most five could be due to free protons, giving a cross-section for annihilation $\leq 86\ ^{+58}_{-37}$ mb. The inelastic scattering from nuclei has a small cross-section, $45\ ^{+22}_{-16}$ mb, comparable with that of the charge-exchange process leading to antineutrons. S.J.Goldsack

539.17 : 539.14

8320. INELASTIC SCATTERING OF NUCLEONS AND DEUTERONS FROM SPHEROIDAL NUCLEI. J.Sawicki.
Nuclear Phys., Vol. 7, No. 5, 503-15 (July [2], 1958).

A direct interaction theory of the inelastic scattering of nucleons and deuterons from strongly deformed nuclei of $A \cong 25$ is proposed. The nucleus is described by the strong-coupling approximation of the unified nuclear model. Two alternative forms of the transition operators are discussed: the projectile-surface interaction and the interparticle forces (projectile-target nucleons). Both the rotational and the individual particle excitations are discussed. As an example of the recent data on the $Mg^{24}(d,d')$ and $Mg^{24}(p,p')$ reactions are considered. Angular correlations with γ's are discussed. The case of the 2+ (rotational level) $\rightarrow$ 0 + E2-radiation is considered in detail. A.

539.17 : 539.14

8321. EXCITATION OF VIBRATIONAL AND ROTATIONAL STATES OF NUCLEI DUE TO SCATTERING OF NUCLEONS.
S.I.Drozdov.
Zh. éksper. teor. Fiz., Vol. 34, No. 5, 1288-91 (1958). In Russian.

Scattering of fast nucleons by black nuclei possessing rotational or vibrational levels is considered in the adiabatic approximation. It is shown that in the diffraction region of scattering angles the shape of the angular distributions of nucleons of definite energy, which are scattered with an excitation of a given collective level of an even-even nucleus, does not depend on whether the level is a rotational or vibrational one. A.

539.17

8322. COMPARISON BETWEEN EXPERIMENTAL AND THEORETICAL ANGULAR DISTRIBUTIONS OF SOME PROTON GROUPS FROM $B^{10}(d,p)B^{11}$ and $O^{18}(d,p)O^{19}$. B.Sjögren.
Ark. Fys., Vol. 12, Paper 24, 537-42 (1957).

Deuterons of 0.800 MeV were used to induce the $B^{10}(d,p)B^{11*}$ reaction (the residual nucleus being in the state with 7.99 MeV excitation) and the proton angular distribution was measured. This was compared with a crude theoretical distribution, obtained by adding an isotropic compound-nucleus contribution and a stripping contribution calculated from the theories of Butler (Abstr. 8973/1951) and Bhatia et al. (Abstr. 6756/1952). The angular distributions reported previously for protons from the reactions $B^{10}(d,p)B^{11*}$ (residual nucleus in the 6.76, 6.81 and 7.80 MeV excited states), $O^{18}(d,p)O^{19*}$ (residual nucleus in the 0.096 MeV excited state) and $O^{18}(d,p)O^{19}$ were treated similarly. If the interaction radii were suitably chosen, the theoretical curves agreed well with experiment. A.E.I. Research Laboratory

539.17

8323. PROTON ANGULAR DISTRIBUTIONS FROM THE REACTION $N^{14}(d,p)N^{15}$. B.Sjögren and K.Ahnlund.
Ark. Fys., Vol. 12, Paper 26, 547-52 (1957).

The first and second excited state proton groups from the $N^{14}(d,p)N^{15}$ reaction were studied at a bombarding energy of 0.8 MeV, using a double focusing magnetic spectrometer. For protons corresponding to the first excited state in N^{15} at 5.276 MeV, the distribution is fitted with an $l_n = 2$ stripping curve after subtracting an isotropic background of about 25% of the maximum intensity. An $l_n = 2$ assignment leads to a spin $\frac{1}{2}$, $\frac{3}{2}$, $\frac{5}{2}$ or $\frac{7}{2}$ for this level. For the 5.305 MeV level there is evidence for a slight contribution from deuteron stripping, with $l_n = 0$, which would correspond to a level spin of $\frac{1}{2}$ or $\frac{3}{2}$. A.E.I. Research Laboratory

539.17

8324. STRIPPING-TYPE NUCLEAR REACTIONS.
T.Fulton and G.E.Owen.
Phys. Rev., Vol. 108, No. 3, 789-94 (Nov. 1, 1957).

An exact formal expression is derived which treats the initial and final states of a nuclear reaction in a symmetric manner. The specific example treated is the (d,n) reaction. The Coulomb interaction is not taken into account. Estimates of some of the terms of the general expression which is obtained provide some indication of the reasons for the similarity of the final results of the various approaches to direct interaction. One of the terms of the development includes effects of compound-nucleus formation. Suggestions are made for a single-particle model of the intermediate state. The process of exchange and heavy-particle stripping is incorporated into the formalism in the appendix. A.

539.17

8325. THE THEORY OF (d,p) AND (d,n) REACTIONS.
O.H.Sÿtenko.
Ukrayin. fiz. Zh., Vol. 2, No. 1, 3-13 (1957). In Ukrainian, with summaries (1 p.) in Russian and ($\frac{1}{2}$ p.) in English.

The interference between the stripping and compound nucleus formation in the (d,p) reaction is considered. For stripping the proton angular distribution is found to be the same as that obtained by Butler (Abstr. 8973/1951), whilst for compound nucleus formation the result found agrees with Blatt and Biedenharn (Abstr. 1100/1953). C.R.S.Manders

539.17

8326. ANGULAR DISTRIBUTIONS FOR SOME (d,p) REACTIONS.
I.B.Teplov and B.A.Yur'ev.
Zh. éksper. teor. Fiz., Vol. 34, No. 2, 334-40 (1958). In Russian.

The angular distribution of some proton groups produced by 4 MeV deuterons in (d,p) reactions on silicon, phosphorus, sulphur and chlorine were determined. The results show that in those cases when the neutrons were captured with $l = 2$, the maximum of the differential cross-section was displaced towards small angles with respect to the maximum computed from Butler's theory. Comparison of the angular distributions for the investigated reactions reveals that interference between the stripping reaction and formation of a compound nucleus exerts an appreciable influence on the shape of the angular distributions. A.

539.17

8327. ANGULAR DISTRIBUTION OF INELASTICALLY SCATTERED DEUTERONS.
V.I.Mamasakhlisov and T.I.Kopaleishvili.
Zh. éksper. teor. Fiz., Vol. 34, No. 5, 1169-75 (1958). In Russian.

Inelastic scattering of deuterons on Mg^{24} and C^{12} nuclei is considered on basis of a generalized nuclear model. The Mg^{24} nucleus is considered to be deformed and the C^{12} nucleus to be spherical. The angular distributions of scattered deuterons are computed taking into account Coulomb interaction by assuming that a rotational level is excited in the Mg^{24} nucleus as a result of collision with a dueteron, whereas a single photon is excited in the C^{12} nucleus. The results obtained are compared with the experimental data. A.

539.17 : 539.14

8328. ON INELASTIC SCATTERING OF DEUTERONS. M.El Nadi.
Zh. éksper. teor. Fiz., Vol. 34, No. 5, 1207-10 (1958). In Russian.

Inelastic scattering of deuterons is assumed to occur in some cases by direct interaction. The incident deuteron is merely scattered and forms the outgoing particle. An expression is derived for the angular distribution of the scattered deuterons and found to agree with the experimental observations for 14.4 MeV deuterons scattered from the 4.61 MeV level of Li^7. A.

539.17

8329. EXPERIMENTAL SURVEY OF NUCLEAR TRANSFORMATIONS CAUSED BY 2 MeV LITHIUM IONS.
E.Norbeck, Jr and C.S.Littlejohn.
Phys. Rev., Vol. 108, No. 3, 754-9 (Nov. 1, 1957).

Ion beams of Li^7 or Li^6, between 1 and 2 MeV in kinetic energy, produced in a Van de Graaff accelerator were used to bombard targets containing light elements and some of the induced nuclear reaction products were detected. Detection was by observation of the induced radioactivity, or by counting charged particles, or by activation of copper by means of the fast neutrons produced. Existence of the following reactions was demonstrated:

Target	Beam	Products
Li^6	Li^6	$C^{11} + n$; $He^5 + Be^7$
Li^6	Li^7	$C^{11} + 2n$; $B^{12} + p$; $C^{12} + n$
Li^7	Li^7	$B^{13} + p$; $B^{12} + d$; $Be^8 + He^6$; $C^{13} + n$
Be^9	Li^6	$N^{13} + 2n$; $N^{14} + n$
Be^9	Li^7	$B^{12} + He^4$; $Be^8 + Li^8$; $N^{15} + n$
B^{10}	Li^6	$O^{15} + n$; $O^{14} + 2n$; $C^{11} + He^5$
B^{10}	Li^7	$O^{15} + 2n$
C^{12}	Li^6	$F^{17} + n$
C^{12}	Li^7	$F^{18} + n$

Yield v. bombarding-energy curves were obtained for the Li–Li reactions and the Be^9 reaction producing Li^8. Resonances in the yield were not observed. Some of the reactions are capable of producing neutrons of 20 MeV energy; the existence of neutrons above 11 MeV was demonstrated by initiating the reaction $Cu^{63}(n,2n)Cu^{62}$, which requires this energy. A search for the production of N^{13} from the reaction $B^{10}(Li^7,H^4)N^{13}$ through the range of bombarding energy indicated by the mass range through which H^4 would be stable against heavy-particle break up gave a null result, indicating that H^4 is unstable. Estimates for the yield at 2 MeV bombarding energy were made for all reactions except that leading to F^{17}. A.

539.17

8330. SCATTERING OF HIGH-ENERGY ELECTRONS FROM C^{12} ON THE INTERMEDIATE-COUPLING MODEL.
M.K.Pal and M.A.Nagarajan.
Phys. Rev., Vol. 108, No. 6, 1577-83 (Dec. 15, 1957).

The nuclear matrix elements of 1p-nuclei for intermediate coupling, which have been worked out in a previous paper (Abstr. 7150/1957), are used in the case of C^{12} to calculate the elastic form factor and the inelastic form factor corresponding to the excitation of the nucleus to its 4.43 MeV level. For the 7.65 MeV level only the monopole transition matrix element is calculated. The difficulty that has been faced in making a tentative 2^+ assignment to the 9.61 MeV level is pointed out by discussing the observed magnitude of inelastic 4.43 MeV scattering and position of the 15.09 MeV ($J = 1$, $T = 1$) level. A.

539.17

8331. PHOTONEUTRONS FROM NATURAL MAGNESIUM.
B.M.Spicer, F.R.Allum, J.E.E.Baglin and H.H.Thies.
Austral. J. Phys., Vol. 11, No. 2, 273-6 (June, 1958).

The photoneutron yield from natural Mg was measured as a function of γ-ray energy from 8 to 17 MeV, and the curve analysed by the photon difference method to produce the cross-section variation. A peak of 2.6 mb near 13 MeV supports previous work by Katz, although the interpretation of this peak is revised. Contradictory results by Nathans and Yergin, using oxides of enriched Mg isotopes could be attributable to faulty subtraction of the yield from the oxygen. A.E.I. Research Laboratory

539.17

8332. GAMMA-RAY EXCITATION OF Ta^{181} ISOMER.
J.E.Draper and R.L.Hickok.
Phys. Rev., Vol. 108, No. 5, 1280-3 (Dec. 1, 1957).

The 615 keV isomeric state in Ta^{181} was excited by 6 MeV bremsstrahlung gamma-rays. The half-life and gamma-ray spectra were measured with a NaI(Tl) scintillation detector. The measured half-life is 18.1 ± 0.3 μsec. The relative intensities of the 134 keV, 346 keV, and 482 keV gamma-rays and the 56 keV X-ray from internal conversion are 57, 16, 100, and 32, and agree with the results obtained from the excitation of this state by beta decay of Hf^{181}. An estimate of the yield is given. A.

539.17

8333. DEUTERON PHOTOEFFECT WITH A REPULSIVE CORE. M.L.Rustgi.
Rev. Mexicana Fis., Vol. 6, No. 3, 135-40 (July, 1957).

An analytic result is given for the electric dipole contribution to the deuteron photoeffect (disintegration of the deuteron by γ-rays) cross-section, for a central Serber force containing am r^{-2} repulsive core. A comparison between calculations and experiment indicates that for energies greater than 60 MeV other effects, like the interaction in the final state and mesonic effects, are of more importance than the inclusion of this repulsive core. Sum rule calculations are also discussed. A.

539.17

8334. PHOTODISINTEGRATION OF Be^9 AND C^{12} BY γ-BREMSSTRAHLUNG OF 44 MeV MAXIMAL ENERGY.
I.V.Chuvilo and V.G.Shevchenko.
Zh. éksper. teor. Fiz., Vol. 34, No. 3, 593-8 (1958). In Russian.

Results of investigation of the angular and energy distributions of protons produced in the photodisintegration of Be^9 and C^{12} are presented. Analysis of the results indicates that in the region of giant resonances the interaction between γ-quanta and the investigated nuclei can be satisfactorily explained by the resonance theory of the intermediate nucleus. At energies above the giant resonance the γ-quanta predominantly interact with separate structures within the nuclei. A.

539.17

8335. ON THE THEORY OF PHOTONUCLEAR REACTIONS.
V.M.Agranovich and V.S.Stavinskii.
Zh. éksper. teor. Fiz., Vol. 34, No. 3, 700-6 (1958). In Russian.

The cross-section for capture of γ-quanta by nuclear matter in the energy range corresponding to giant resonance is computed. A.

539.17

8336. PHOTODISINTEGRATION OF HELIUM. II.
A.N.Gorbunov and V.M.Spiridonov.
Zh. éksper. teor. Fiz., Vol. 34, No. 4, 862-5 (1958). In Russian.

For previous part see Abstr. 3380 (1958). A cloud chamber was employed to study the $He^4(\gamma,n)He^3$ reaction. The method of treatment of the He^3 track data is described. The dependence of the cross-section of the reaction on the γ-quantum energy and also the reaction products angular distributions were measured. A.

539.17

8337. PHOTODISINTEGRATION OF HELIUM. III.
A.N.Gorbunov and V.M.Spiridonov.
Zh. eksper. teor. Fiz., Vol. 34, No. 4, 866-73 (1958). In Russian.

Some results of investigation of the reaction $He^4(\gamma,pn)D$ and also a summary of results on photodisintegration of He^4 are presented. The dependence of the cross-section of the reaction (γ,pn) on γ-quantum energy and the angular distributions of the neutrons and protons produced in this reaction are presented. Correlation in the emission of protons, neutrons and deuterons is studied. Values of $\sigma_{int} = 95 \pm 7$ MeV millibarns and $\sigma_0 = (2.4 \pm 0.15)$ millibarns are computed from the curves of the cross-sections for the (γ,p), (γ,n) and (γ,pn) reactions on He^4. The results are discussed with the purpose of elucidating the nature of the interaction between γ-quanta and the He^4 nucleus at various γ-quantum energies. The results are also compared with the theoretical predictions of photodisintegration of He^4. A.

539.17

8338. SOME PHOTO-REACTIONS ON LIGHT NUCLEI.
V.N.Malkov.
Zh. éksper. teor. Fiz., Vol 34, No. 6, 1406-19 (1958). In Russian.

Photographic emulsions were employed to investigate the reactions $C^{12}(\gamma,3\alpha)$, $O^{16}(\gamma,4\alpha)$, $(\gamma,p\alpha)$ on C^{12}, N^{14}, O^{16}, and $C^{12}(\gamma,pt)2\alpha$. The dependence of the effective cross-section of the reactions on the γ-quantum energy and also the energy and angular characteristics of the disintegration products were determined. The contribution of the reactions $C^{12}(\gamma,p\alpha)Li^7$ and $C^{12}(\gamma,pt)2\alpha$ to the total cross-section for star formation in the photon energy region from 30 to 80 MeV is estimated. Some possible mechanisms of the $(\gamma,p\alpha)$ processes are discussed. A.

539.17

8339. PHOTODISINTEGRATION OF A^{40}. I.P.Yavor.
Zh. éksper. teor. Fiz., Vol. 34, No. 6, 1420-5 (1958). In Russian.

Photodisintegration of A^{40} nuclei induced by γ-bremsstrahlung of 70 MeV peak energy was investigated in a cloud chamber. The various types of photodisintegration, as well as the integral cross-section for the reaction (γ,p) were determined. The energy and angular distributions of photo-protons from argon were derived. A.

539.17

8340. $Co^{56}(n,\alpha)Mn^{56}$ AND $Mn^{55}(n,\alpha)V^{52}$ REACTIONS INDUCED BY 14.8 MeV NEUTRONS.
I.Kumabe, E.Takekoshi, H.Ogata, Y.Tsuneoka and S.Oki.
J. Phys. Soc. Japan, Vol. 13, No. 2, 129-32 (Feb., 1958).

The angular and energy distributions of alpha particles resulting from these reactions were measured with Ilford C2 nuclear plates. As in the case of the $Al^{27}(n,\alpha)Na^{24}$ reaction, the angular distributions for the entire energy region are approximately 90° symmetrical and concave upward, and the energy distributions show that the alpha particles with energies below the Coulomb barrier are emitted more than would be expected. The curves on a semilog plot of the relative level density, calculated from the energy distributions of the alpha particles, do not fit a straight line. The total (n,α) cross-sections of cobalt and manganese are 84 millibarns ± 15% and 96 millibarns ± 15%, respectively. The results are compared with the predictions of the statistical theory of nuclear reactions. A.

539.17

8341. ALPHA PARTICLES FROM THE INTERACTION OF 14.8 MeV NEUTRONS WITH MEDIUM WEIGHT NUCLEI. I.Kumabe.
J. Phys. Soc. Japan, Vol. 13, No. 4, 325-34 (April, 1958).

The angular and energy distributions of alpha-particles resulting from the $V^{51}(n,\alpha)Si^{48}$ and $S^{32}(n,\alpha)Si^{29}$ reactions induced by 14.8 MeV neutrons were measured with Ilford C2 nuclear plates. It was found that the angular distributions for the entire energy regions in the centre-of-mass system are concave upward and approximately 90° symmetrical, and the energy distributions show that more alpha-particles with energies below the Coulomb barrier are emitted than expected. Also the curve on a semilog plot of the relative level density calculated from the energy distributions of the alpha-particles fits a straight line which would correspond to Maxwellian distributions with the temperatures of about 0.9 MeV for Sc and about 1.5 MeV for Si. The total cross-sections of V and S are 126 mb ± 15% and 109 mb ± 15% respectively. Experimental data on (n,α) reactions so far obtained are summarized and discussed in detail. A.

539.17

8342. EXCITATION CURVE FOR THE REACTION $P^{31}(n,p)Si^{31}$.
S.Morita.
J. Phys. Soc. Japan, Vol. 13, No. 5, 431-3 (May, 1958).

The excitation curve was measured in the neutron energy range from 3.0 MeV to 5.2 MeV by the activation method. A large resonance peak of 160 mb was found at the neutron energy of 4.9 MeV. A.

539.17

8343. SPECTRUM OF PROTONS FROM n, p REACTIONS AT 13.4 AND 17.5 MeV.
L.Colli, M.Pignanelli, A.Rytz and R.Zurmühle.
Nuovo Cimento, Vol. 9, No. 2, 280-8 (July 16, 1958).

Measurements are presented of the energy distribution of protons emitted in (n, p) reactions on Al and Ni in the natural isotopic mixture. These measurements were taken with neutrons of energy of 17.5 and 13.4 MeV, for the purpose of studying how the proton energy distribution varies with the incoming neutron energy, in order to establish which process is responsible for the (n, p) reaction. The results give evidence of the fact that the statistical evaporation theory is unsuitable for explaining the proton spectra obtained, and that the spectrum shape does not depend on the residual nucleus excitation energy but seems determined more by the energy of emitted protons. A.

539.17

8344. THERMAL-NEUTRON ACTIVATION CROSS SECTIONS OF Ge AND THE ISOMERIC RATIO RULE.
E.der Mateosian and M.Goldhaber.
Phys. Rev., Vol. 108, No. 3, 766-8 (Nov. 1, 1957).

The cross-sections of Ge^{74} and Ge^{76} were determined. Contrary to indications obtained from previously published neutron cross-section compilations, the present results are in agreement with the isomeric ratio rule, which states that the ratio of cross-sections for the production of two isomeric states by slow neutron capture is such that the isomeric state with spin close to that of the compound nucleus is favoured. A.

539.17

8345. SCATTERING OF FAST NEUTRONS FROM C^{12} AND F^{19}.
J.E.Wills, Jr, J.K.Bair, H.O.Cohn and H.B.Willard.
Phys. Rev., Vol. 109, No. 3, 891-7 (Feb. 1, 1958).

High resolution total cross-section measurements were made in the vicinity of the neutron-scattering resonance occurring in C^{12} at (2.076 ± 0.008) MeV bombarding energy with a total width of 7 keV. These data, coupled with differential cross-section measurements in the same energy range, lead to the assignment of $D_{5/2}$ to this state in C^{13}. Angular distributions of neutrons scattered from C^{12} measured between 1.45 and 4.10 MeV were analysed in terms of partial waves. The resulting phase shifts indicate that the $D_{3/2}$ state occurring at 2.95 MeV has a width of 90 keV, while the $D_{3/2}$ state at 3.67 MeV has a width of 1.69 MeV. Total cross-section measurements for fluorine, having resolutions of 20 and 70 keV, indicate the presence of resonances at 1.10 and 2.25 meV, as well as some structure above 3 MeV not previously reported. Angular distributions were measured between 0.66 and 2.92 MeV. A.

539.17

8346. TOTAL NEUTRON CROSS SECTIONS NEAR 14 MeV.
J.F.Vervier and A.Martegani.
Phys. Rev., Vol. 109, No. 3, 947-8 (Feb. 1, 1958).

The total cross-section of U, Al, Mg, Cu and C were measured for neutron energies near 14 MeV by transmission experiments. The agreement with previous measurements is satisfactory; results are compared with theoretical predictions. A.

539.17

8347. TOTAL NEUTRON CROSS SECTIONS NEAR 14.1 MeV.
J.P.Conner.
Phys. Rev., Vol. 109, No. 4, 1268-72 (Feb. 15, 1958).

Total cross-sections of C, Ca, Ti, Ba, La, Ce, Nd, Sm, Gd, Er, Ta, Au and Pb for neutrons of energies between 13.1 and 15.6 MeV were measured by the transmission technique with good geometry. The range of neutron energy was achieved by observing neutrons at various angles from thin tritium targets bombarded by deuterons of energy up to 450 keV. Geometry was such that a scattering in the sample of more than about 2° removed the neutron from the beam to the stilbene scintillation detector. The total cross-section of carbon for neutrons was found to vary from 1.41 barns at 13.1 MeV to a minimum of 1.31 barns at 14.2 MeV to 1.49 barns at 15.6 MeV. Other elements showed smaller cross-section variation with energy. A.

539.17

8348. ACTIVATION CROSS SECTION FOR THE REACTION $Na^{23}(n,p)Ne^{23}$.
C.F.Williamson, E.L.Hudspeth, I.L.Morgan and R.G.Moore.
Phys. Rev., Vol. 110, No. 1, 139-42 (April 1, 1958).

The absolute reaction cross-section for $Na^{23}(n,p)Ne^{23}$ was measured in the range of neutron energies from 3.3 to 8.2 MeV by use of neutrons from the reactions $H^3(d,n)He^3$ and $N^{14}(d,n)O^{15}$. The cross-section rises from a threshold at about 3.7 MeV to 12 millibarns at the highest energy studied. Twelve resonances are observed corresponding to excited levels in Na^{24}. The region of energy overlap between the neutrons from $H^3(d,n)He^3$ and $N^{14}(d,n)O^{15}$ gives values of the $N^{14}(d,n)O^{15}$ cross-section which are in rough agreement with those previously measured elsewhere. Over-all accuracy is estimated to be ± 20% for $H^3(d,n)He^3$ data, and ± 50% for $N^{14}(d,n)O^{15}$ data. A.

539.17

8349. ENERGY DEPENDENCE OF THE REACTION CROSS-SECTION FOR SLOW NEUTRONS. F.L.Shapiro.
Zh. éksper. teor. Fiz., Vol. 34, No. 6, 1648-9 (1958). In Russian.

The constant term in the cross-section at low energies can be obtained from the same considerations as the 1/v term.

G.E.Brown

539.17

8350. CROSS-SECTION FOR INTERACTION OF π-MESONS WITH HYDROGEN NUCLEI. V.T.Osipenkov and S.S.Filippov.
Zh. éksper. teor. Fiz., Vol. 34, No. 1, 224-6 (1958). In Russian.

The interaction of π-mesons with the carbon nucleus is described in terms of the optical model, and parameters for the latter are computed from forward meson–nucleon scattering amplitudes. Calculations using both the exact and semi-classical formulae are carried out and compared with experiment in the region 0-350 MeV. G.E.Brown

539.17

8351. URANIUM FISSION PRODUCTS IN THE RARE-EARTH-ELEMENT REGION OBTAINED BY IRRADIATION WITH 660 MeV PROTONS. F.I.Pavlotskaya and A.K.Lavrukhina.
Zh. éksper. teor. Fiz., Vol. 34, No. 5, 1058-69 (1958). In Russian.

Data obtained by a radiochemical method are presented for the fission products of uranium produced in the rare-earth region by irradiation with 660 MeV protons. The total rare-earth-element yield was 0.7×10^{-24} cm^2, which is about 20% of the yield of all fission fragments. When the fission is strongly asymmetric the yields of stable isotopes and also of isotopes with an excess of deficiency in neutrons are approximately equal. Maximal yield of light rare-earth-elements is observed in the region of nuclear stability; the heavy rare-earth fission products are predominantly neutron deficient isotopes. It is shown that the distribution of rare-earth elements observed under natural conditions cannot be explained by heavy-nucleus fission induced by high-energy particles. A.

539.17

8352. NUCLEAR CHARGE DISTRIBUTION IN THE FISSION OF URANIUM AND THORIUM WITH 13.6 MeV DEUTERONS. J.M.Alexander and C.D.Coryell.
Phys. Rev., Vol. 108, No. 5, 1274-80 (Dec. 1, 1957).

Measurements were made of independent fission yields and valley-to-peak ratios in 13.6 MeV deuteron fission and fast-neutron fission of U^{238} and Th^{232}. From these measurements the conclusion is drawn that deuteron capture precedes a large fraction of the deuteron-induced fission events. The primary distribution of yields along a mass chain can be adequately explained by the postulate of equal charge displacement with the same distribution curve found applicable in low-energy neutron fission, best results requiring a slightly greater tendency for neutron emission in the heavy fragments. A.

539.17

8353. FISSION YIELDS OF NATURAL URANIUM WITH DEUTERONS OF 5, 10 AND 13.6 MeV: DEUTERON CAPTURE AND COMPETITION WITH STRIPPING.
T.T.Sugihara, P.J.Drevinsky, E.J.Troianello and J.M.Alexander.
Phys. Rev., Vol. 108, No. 5, 1264-73 (Dec. 1, 1957).

Radiochemical determinations of yields in the fission of natural uranium with 5, 10, and 13.6 MeV deuterons were made for 35 mass chains from mass numbers 72 to 159. The total fission cross-sections at the three energies were found to be 3.5, 86, and 430 mb, respectively, by integration of the mass-distribution curve. These cross-sections include contributions from the fast-neutron background, which is negligible at the two higher energies but which constitutes nearly all of the observed fission at 5 MeV. Although in gross features the yield-mass curves resemble those for other fissile nuclei, some important differences are apparent. The highly asymmetric yields change nearly as rapidly with energy as those of the valley; the deuteron yield curves are the broadest that have been observed at these energies. From analysis of yield measurements for nearly complementary masses it has been found that fewer neutrons are emitted in modes leading to highly asymmetric products as compared to the most probable modes. The average number of neutrons per fission is found to be 3.5, 5.0, and 5.0 with deuterons of 5, 10, and 13.6 MeV. The measured valley-to-peak yield ratios at 10 and 13.6 MeV are smaller than would be expected from deuteron capture. It is concluded that at these energies a small but significant contribution is made by fission following a (d,p) or (d,n) stripping reaction. From known (d,p), (d,n), and fission cross-sections, the proton-energy spectrum in (d,p) stripping on heavy nuclei, and estimated branching ratios for modes of decay of a heavy excited nucleus, it is calculated that the fraction of fission events following deuteron capture is 0.8 ± 0.2 with 13.6 MeV deuterons and 0.75 ± 0.25 with 20 MeV deuterons, the remainder following a (d,p) or (d,n) stripping reaction. A.

539.17

8354. FISSION OF URANIUM NUCLEI AND FORMATION OF MULTICHARGED FRAGMENTS ON PHOTOGRAPHIC EMULSION NUCLEI, BOTH INDUCED BY HIGH-ENERGY π^+-MESONS. N.S.Ivanova.
Zh. éksper. teor. Fiz., Vol. 34, No. 6, 1381-8 (1958). In Russian.

The interaction between 280 MeV π^+-mesons and uranium nuclei accompanied by fission was studied with the help of nuclear emulsions. From an analysis of the light charged particles emitted in fission it is concluded that π^+-meson absorption predominantly occurs in the interaction involving a pair of nucleons (n,p). The main features of uranium fission induced by high-energy π^+-mesons are investigated. Some peculiarities of production of multicharged ($Z \geq 4$) fragments from the emulsion nuclei induced by high-energy positive π-mesons are noted. The cross-section for production of such fragments on heavy emulsion nuclei (Ag, Br) is estimated. A.

539.17

8355. ANGULAR ANISOTROPY OF EMISSION OF FRAGMENTS IN THE FISSION OF Pu^{239} BY 14 MeV NEUTRONS. A.N.Protopopov and V.P.Élʹsmont.
Zh. éksper. teor. Fiz., Vol. 34, No. 1, 250-1 (1958). In Russian.

Measurements carried out with an ionization chamber give an anisotropy of 1.15 ± 0.05 for Pu^{239} and 1.28 ± 0.07 for U^{238}. These and other results show a steady decrease in anisotropy with increasing Z^2/A. G.E.Brown

539.17

8356. MAGNETIC ANALYSIS OF THE LONG-RANGE PARTICLES FROM FISSION OF U^{235}. C.B.Fulmer and B.L.Cohen.
Phys. Rev., Vol. 108, No. 2, 370-2 (Oct. 15, 1957).

The long-range particles from pile-neutron fission of U^{235} were studied with a high-resolution magnetic spectrograph. The particles were detected with a CsI(Tl) crystal scintillator; differential pulse-height analysis was used. Scintillation pulse height v. $H\rho$ data show that the particles have the same value of e^2/m as alpha-particles. The range–energy relationship for the particles in aluminium was studied; this showed that the particles have the same value of me^2 as alpha-particles. Since the long-range particles have the same e^2/m value and the same me^2 value as alpha-particles, they have the same values of e and m; this confirms that they are alpha-particles as was indicated by previous studies. The energy distribution of the particles as determined here is in good agreement with previous determinations by other methods. An extensive search revealed no fine structure in the energy distribution. The shape of the energy distribution indicates that the particles are formed at the instant of fission. A.

539.17

8357. MASS DISTRIBUTION IN FISSION OF U^{235} BY RESONANCE NEUTRONS. R.Nasuhoglu, S.Raboy, G.R.Ringo, L.E.Glendenin and E.P.Steinberg.
Phys. Rev., Vol. 108, No. 6, 1522-3 (Dec. 15, 1957).

Radiochemical analyses of samples of U^{235} irradiated with monoenergetic neutrons at 1.1, 3.1 and 9.0 eV indicated that the fission yield of Ag^{111}, Cd^{115}, and Sb^{127} relative to the yield of Sr^{89} does not change from that produced by thermal neutrons. A.

539.17 : 539.166

8358. INVESTIGATION OF γ-RAYS EMITTED IN THE FISSION OF U^{235} INDUCED BY 2.8 AND 14.7 MeV NEUTRONS. A.N.Protopopov and B.M.Shiryaev.
Zh. éksper. teor. Fiz., Vol. 34, No. 2, 331-3 (1958). In Russian.

γ-Rays coinciding in time with fission fragments were recorded with a scintillation counter. It is shown that the γ-ray spectrum is the same for U^{235} fission induced by 2.8 and 14.7 MeV neutrons, as for fission induced by thermal neutrons. It is concluded that the total γ-quantum energy per U^{235} fission event induced by 2.8 and 14.7 MeV neutrons is the same to within 15% with that for thermal neutron induced fission. A.

539.17

8359. EFFECTS OF REACTIVITY PERTURBATIONS ON THE DENSITY OF THE NEUTRONS FROM A NUCLEAR REACTOR. B.Cimbleris.
An. Acad. Brasil. Ciênc., Vol. 29, No. 4, 535-43 (1957).

n Portuguese.

Both the perturbation and the neutron density are expanded in a Fourier series and the form of the various harmonics is investigated. Higher harmonics are more important at low intensities.

L.Pincherle

539.17 : 539.1.07

MINIATURE FISSION CHAMBER. See Abstr. 8183

539.17 : 517.564

8360. ON THE RATE OF CONVERGENCE OF THE SPHERICAL-HARMONICS METHOD FOR A SANDWICH REACTOR OF SMALL LATTICE PITCH. B.Davison.
Canad. J. Phys., Vol. 36, No. 6, 784-800 (June, 1958).

There are some cases where the spherical-harmonics-method calculations can be carried out purely algebraically, without specifying numerically the order of approximation used. Such is the problem of determining the spatial distribution of the thermal neutron flux in an infinite sandwich reactor of a small lattice pitch. The spherical-harmonics-method solution of this problem, in an arbitrary order of approximation, is compared with the exact solution. It is shown that if both are expanded in the Fourier series in terms of the optical depth, the nth term of the Fourier series for the spherical-harmonics-method solution differs from the corresponding term for the exact solution by the factor

$$[\tanh(N\epsilon/n\pi) + O(\epsilon)],$$

where N is the order of approximation used in the spherical-harmonics method and ϵ is one half of the lattice pitch on the optical scale. This result should provide some guidance in assessing the rate of convergence of the spherical-harmonics method also for the more complex (and realistic) cases. A.

539.17

8361. EIGHT REACTOR TYPES — A THERMODYNAMIC COMPARISON. S.Baron.
Nucleonics, Vol. 16, No. 6, 64-7 (June, 1958).

Theoretical steam-cycle efficiencies of the various types are compared and the underlying design parameters outlined.

R.D.Smith

539.17

8362. UPPING E.B.W.R.'S POWER. J.A.DeShong, Jr.
Nucleonics, Vol. 16, No. 6, 68-72 (June, 1958).

The transfer function of the Experimental Boiling Water Reactor was measured from 0.01 to 25 radians/sec for various conditions of coolant flow and pressure for powers up to 20 MW. An analytical expression was found for the transfer function and a model which accurately represented the reactor developed. On the basis of this model the reactor behaviour at powers up to 60 MW was predicted and subsequently experimentally confirmed. R.D.Smith

539.17

8363. MEASURING REACTOR SPECTRA WITH THRESHOLDS AND RESONANCES. J.B.Trice.
Nucleonics, Vol. 16, No. 7, 81-3 (July, 1958).

Miniature fission chambers together with activation measurements were used to determine neutron spectra in the B.S.R., L.I.T.R., X-10 and M.T.R. reactors. Suitable resonance detectors and threshold reactions are listed. Accurate cross-section data is essential to the success of the method. R.D.Smith

539.17

8364. THE IMPORTANCE FUNCTION IN REACTOR KINETICS. H.Grümm and K.H.Höcker.
Z. angew. Phys., Vol. 9, No. 6, 305-13 (June, 1957). In German.

The elementary formulae of reactor kinetics are calculated for the time variations of reactivity occurring in a homogeneous thermal reactor when, for example, a control rod is moved slightly. The concept of the "importance function" is explained, its equations are examined and applied to some problems in reactor kinetics. It is also used in two-group diffusion-theory when examining, for example, a reactor with a reflector. D.H.Lord

539.17 : 538.566 : 621.396.823

8365. ELECTROMAGNETIC NOISE AND PROPAGATION OBSERVATIONS IN THE VICINITY OF A NUCLEAR REACTOR. W.W.Fain, C.M.Crain and W.C.Duesterhoeft.
I.R.E. Trans Antennas and Propagation, Vol. AP-6, No. 3, 286-8 (July, 1958).

Electromagnetic noise and propagation measurements have been made in the vicinity of a nuclear reactor to determine whether reactor radiation would affect X-band and v.h.f. signals. No radiation effects were observed. A 15 foot X-band propagation path was instrumented for observation of attenuation and phase changes. The overall sensitivity was one part in 10^5 or 10 N units average over the path. Reactor radiation over the path was greater than 10^4 r/hr. No significant phase or attenuation change was observed as reactor power level varied. A 12 dB noise figure, 8 Mc/s bandwidth, 18 in. dish aerial, X-band receiving system, and a 12 dB noise figure, 4 Mc/s bandwidth, tuned dipole aerial, 94 Mc/s receiving system were pointed at the reactor from approximately 18 ft. No significant electromagnetic noise generated by reactor radiation was observed with these receiving systems. A.

539.17 : 539.12

8366. ATTENUATION OF γ-RAYS FROM AN INFINITE PLANE. M.G.Chasanov and M.Shatzkes.
Nucleonics, Vol. 16, No. 6, 63 (June, 1958).

Nucleonics data sheet No. 25. A nomogram for use in shielding calculations. R.D.Smith

ATOMS

539.18

8367. ELECTRON SPIN RESONANCE OF NITROGEN ATOMS TRAPPED AT LIQUID HELIUM TEMPERATURE.
S.N.Foner, C.K.Jen, E.L.Cochran and V.A.Bowers.
J. chem. Phys., Vol. 28, No. 2, 351-2 (Feb., 1958).

The spectrum of nitrogen atoms trapped in solid H_2, N_2 and CH_4 is in each case a hyperfine triplet. The electronic g-factor is very slightly less, and the hyperfine coupling constant larger by an amount depending on the nature of the matrix, than in the gaseous state. E.F.W.Seymour

539.18

8368. ELECTRON SPIN RESONANCE SPECTRUM OF THE ELECTRICAL DISCHARGE PRODUCTS OF AMMONIA FROZEN AT 4.2°K. T.Cole and J.T.Harding.
J. chem. Phys., Vol. 28, No. 5, 993 (May, 1958).

Atomic species are produced by an electrical discharge in ammonia and trapped in a molecular matrix at 4.2°K. Electron spin resonance lines are observed which are identified as atomic H and N by their hyperfine structures. The concentration is about 1% and no decrease in line intensity was observed in an hour.

J.M.Baker

539.18 : 539.19

8369. SOME EXTRAORDINARY FUNCTIONS FOR IMPROVING CALCULATIONS OF ELECTRONIC ENERGIES.
L.C.Snyder and R.G.Parr.
J. chem. Phys., Vol. 28, No. 6, 1250-1 (June, 1958).

The functions used are the absolute values of the real hydrogen-like atomic orbitals, whose gradients are only piecewise continuous. Mixing of these with conventional atomic orbitals enables the positive and negative lobes to be independently weighted. For the He atom, a function of this type involving only 1s and 2p orbitals is as good as a conventional Taylor–Parr function including also 3d orbitals. J.Hawgood

539.18

8370. OPEN CONFIGURATION CALCULATIONS FOR BERYLLIUM.
G.H.Brigman, R.P.Hurst, J.D.Gray and F.A.Matsen.
J. chem. Phys., Vol. 29, No. 1, 251-2 (July, 1958).

Calculations by the method of Abstr. 3393 (1958) show that opening the 1s exponents in the $1s^22s^2$ configuration makes a bigger energy improvement than the use of Hartree–Fock functions, while the opening of the 2s exponents makes very little further improvement. J.Hawgood

539.18

8371. INVESTIGATION OF THE HYPERFINE-STRUCTURE SPLITTING OF BOTH GROUND STATES $^2D_{3/2}$ AND $^2D_{5/2}$ OF Y^{89} BY THE ATOMIC BEAM RESONANCE METHOD.
D.v.Ehrenstein, G.Fricke, H.Kopfermann and S.Penselin.
Naturwissenschaften, Vol. 44, No. 8, 255-6 (1957). In German.

By varying the frequency of the high-frequency field and the strength of the C-field the transitions between the different levels were measured and unambiguously identified. The ratio of the measured A-factors does not agree with the theoretical prediction. This may be resolved by the "term-perturbations". P.K.Kabir

539.18

8372. AN APPROXIMATION TO THE THOMAS–FERMI FUNCTION. D.G.Sannikov.
Zh. éksper. teor. Fiz., Vol. 34, No. 6, 1650-1 (1958). In Russian.

A simple function is obtained by going from the approximate equations of Lenz and Jensen for the electron density to the Thomas–Fermi function $\varphi(\xi)$. G.E.Brown

539.18 : 539.12

VARIATIONAL CALCULATION OF THE SCATTERING OF ELECTRONS OF NEARLY ZERO ENERGY BY HYDROGEN ATOMS. See Abstr. 8207

539.18 : 539.14

8373. A TABLE OF LEVY'S EMPIRICAL ATOMIC MASSES. J.Riddell.
Atomic Energy of Canada Rep., No. 339, 6 pp. + 84 pp. tables (July, 1956).

Nearly 4000 atomic masses were calculated from Levy's empirical mass equation. These, together with the neutron, proton and alpha-particle binding energies which can be calculated from them, are tabulated. A.

539.18

8374. ATOMIC MASSES OF Kr^{84}, Kr^{86}, Xe^{129}, Xe^{132}, Hg^{200}, Hg^{201} AND Hg^{204}. J.T.Kerr and H.E.Duckworth.
Canad. J. Phys., Vol. 36, No. 7, 986-8 (July, 1958).

These were determined with a large semicircular single-focusing mass spectrometer, with estimated errors about 10^{-4} a.m.u. J.Hawgood

539.18

8375. SEPARATION OF ISOTOPES IN NON-STATIONARY MOLECULAR FLOW. K.D.Sinel'nikov, V.E.Ivanov, B.G.Safronov, Yu.S.Azovskiĭ and G.G.Aseev.
Zh. éksper. teor. Fiz., Vol. 34, No. 2, 327-30 (1958). In Russian.

A change in the isotopic composition was detected in a non-stationary molecular flow of mercury vapour. The time of adsorption of mercury on an iron surface ($\tau^{198} = 3.4 \times 10^{-2}$ sec for T = 293°K) and the ratio of the adsorption times for the Hg^{198} and Hg^{204} isotopes ($\tau^{198}/\tau^{204} = 1.008$) were computed from the results obtained. The heat of adsorption of mercury on iron (15×10^3 cal/mole) is estimated. A.

539.18 : 537.534.3

ELECTRIC MASS-FILTER ISOTOPE SEPARATOR. See Abstr. 8059

539.18

8376. MASS DEPENDENCE OF INELASTIC ATOMIC COLLISIONS. H.B.Gilbody and J.B.Hasted.
Proc. Phys. Soc., Vol. 72, Pt 2, 293-6 (Aug., 1958).

Data from a number of sources is analysed, and it is found that, for incident masses greater than 4 in the cases where adiabatic theory is not obeyed, the maximum cross-section is proportional to the kinetic energy of motion available for internal excitation. P.Gray

539.18

8377. FURTHER CROSS-SECTIONS FOR COLLISIONS BETWEEN ATOMS. H.Pauly.
Z. angew. Phys., Vol. 9, No. 12, 600-6 (Dec., 1957). In German.

Total cross-sections for the collisions of Na, K, Rb and Cs with Hg and N_2 were measured, by attenuation of the primary beams in going through a scattering centre. In measurements with Hg, the scattering centre is provided by a second atomic beam, perpendicular to the primary one. In the experiments with N_2, the partial pressure was raised in steps in the apparatus, and the beam intensity was measured as a function of pressure. G.E.Brown

539.18

8378. A SECOND ORDER CALCULATION OF THE ENERGY OF INTERACTION BETWEEN TWO NORMAL HELIUM ATOMS. N.Lynn.
Proc. Phys. Soc., Vol. 72, Pt 2, 201-6 (Aug., 1958).

The energy of interaction between two normal helium atoms is calculated to the second order using a perturbation method which employs properly symmetrized unperturbed wave-functions. The results obtained are in good agreement with experimentally derived interaction energies for both large and small internuclear separations. A.

MOLECULES

539.19 : 530.145

ADIABATIC SECOND-ORDER ENERGY DERIVATIVES IN QUANTUM MECHANICS. See Abstr. 7712

539.19 : 518.5

8379. SYMMETRIZATION OF SECULAR DETERMINANT FOR NORMAL VIBRATION CALCULATION. T.Miyazawa.
J. chem. Phys., Vol. 29, No. 1, 246 (July, 1958).

Outlines a procedure by which the Wilson matrix method has been carried out on an automatic computer, using standard programmes. J.Hawgood

539.19

8380. VIBRATION FREQUENCIES OF SOME TETRAHEDRAL HYDRIDE IONS. D.A.Brown.
J. chem. Phys., Vol. 29, No. 2, 451-2 (Aug., 1958).

Assuming a spherically symmetric electron distribution, the vibration frequencies of borohydride and borodeuteride are calculated and bands in the infrared spectrum are assigned to the ν_1 and ν_2 vibrations. C.Turner

539.19

8381. MICROWAVE STUDIES OF THE INTERNAL MOTION AND THE STRUCTURE OF METHYL AMINE. T.Nishikawa.
J. Phys. Soc. Japan, Vol. 12, No. 6, 668-80 (June, 1957).

Most of the observed lines, including $J = 1 \leftarrow 0$, $K = 0 \leftarrow 0$ lines were analysed in the frequency range between 4 and 50 kMc/s. The barrier height of internal rotation was determined to be 691.1 cm^{-1}, as well as the molecular structure, $d_{CN} = 1.474$ A, $\angle HNC = 112°10'$, $\angle HNH = 105°50'$, $\angle HCH = 109°30'$ and the angle between CN and the methyl axis = 3°30' on the assumption that $d_{CH} = 1.093$ A and $d_{NH} = 1.014$ A. These results are compared with the barrier height and the structure of other CH_3 MH_n type molecules, methyl alcohol and methyl mercaptan. The inversion doubling of the observed lines was also analysed satisfactorily. The quadrupole coupling constant of N^{14} along the charge symmetry axis was obtained as -3.6 ± 0.3 Mc with the direction of the axis, $90° \pm 8$, from the methyl axis. A.

539.19

8382. DETERMINATION OF THE PERTURBATING TERMS OF SEVERAL LEVELS IN RESONANCE. C.Courtoy and P.Passau.
Ann. Soc. Sci. Bruxelles I, Vol. 72, No. 1-2, 75-9 (1958). In French.

Equations deduced for the perturbating terms are used to determine the Fermi resonance of $C^{12}O_2$ and $C^{13}O_2$. Except for one discrepancy, the values obtained are in good agreement with those previously obtained by Courtoy (Abstr. 7744/1957) using other relationships. G.I.W.Llewelyn

539.19

8383. SPIN DENSITY MATRIX FOR THE ALLYL RADICAL. H.M.McConnell.
J. chem. Phys., Vol. 29, No. 1, 244-5 (July, 1958).

This is calculated from Berthier's unrestricted SCF wave-function (Abstr. 7247/1955), and it is found that there is a negative spin density on the central C atom. J.Hawgood

539.19

8384. ON THE ELECTRONIC STRUCTURE OF DIBORANE. W.C.Hamilton.
J. chem. Phys., Vol. 29, No. 2, 460-1 (Aug., 1958).

Points out that the simplified treatment of B_2H_6 in Abstr. 4568 (1956) gives good agreement with the more complete calculation by Yamazaki in Abstr. 1291 (1958), although the latter doubted this. J.Hawgood

539.19 : 535.343

8385. EFFECT OF THE BASIC STRENGTH OF ATTACHED GROUPS ON LIGHT ABSORPTION SPECTRA. I. LIGHT ABSORPTION OF TRIPHENYLMETHANE DYES. R.Itoh.
J. Phys. Soc. Japan, Vol. 12, No. 6, 644-52 (June, 1957).

The electronic energy levels of typical triphenylmethane dyes, Döbner's Violet and Rosaniline, are calculated through the simple LCAO MO method. The electron densities and the bond orders in the ground states are also computed. Then, with these values of electron densities and bond orders, the differences of the Coulomb and of the resonance integrals, $\Delta\alpha_i$ and $\Delta\beta_{ij}$, respectively, as well as those between the carbon and the nitrogen atoms are taken into account and the electronic energy levels calculated above are modified by the perturbation method. The differences of the Coulomb integrals between the carbon and the nitrogen atoms cause profound effects to the absorption energy which amount to 23-27 kcal (40-50%), whereas those of different carbon atoms affect the absorption by only 4 kcal (10%). The energy levels of the various derivatives of Döbner's Violet and Rosaniline, e.g. dimethyl and diethyl derivatives of Döbner's Violet, Malachite Green, Brilliant Green, Hoffmann's Violet, Crystal Violet, Ethyl Violet etc., are also calculated by the method of perturbation. The values of the Coulomb integrals of attached end groups are estimated through the basicity of the groups

ne calculated absorption energies for these derivatives are com-
ared with the observed light absorptions and it is shown that the
ethod of the calculation is reasonable. A.

539.19 : 535.343

386. EFFECT OF THE BASIC STRENGTH OF ATTACHED ROUPS ON LIGHT ABSORPTION SPECTRA. II. NEAR ULTRA-OLET ABSORPTION SPECTRA OF PARA-SUBSTITUTED ANI-NE DERIVATIVES. R.Itoh.
Phys. Soc. Japan, Vol. 12, No. 7, 809-16 (July, 1957).

The absorption spectra of para-substituted aniline derivatives the type of $A_1C_6H_4B$, where A_1 is one of the electron donating oups such as NH_2, $NHCH_3$, NHC_2H_5, $N(CH_3)_2$, $N(C_2H_5)_2$ etc. and B is e of the electron attracting groups such as COOH, $COCH_3$, CHO, O_2 etc., change with the basic strength of the group A_1. The first sorption maxima of these molecules between 2800 and 4000 A are iginated from the second absorption maxima of unsubstituted mole-les (in 2600-2900 A region) under the influence of the group A_1. his is explained by the semi-empirical MO theory with perturbation. ne effects of B groups are taken into consideration by the delocali-tion of the molecular orbitals of benzene molecule, while the effects A_1 groups are calculated through the method of electron migration, which the non-binding π electrons on the nitrogen atom of A_1 mi-ate to the parent molecule. The induction effect of the substituted kyl group in A_1, which determines the degree of the electron mi-ation, can be estimated from the relative basic strength of the end oup, i.e. the dissociation constant of amine NHR_2. The calculated sorption energies are in good agreement with the observed values the solvent effect is taken into consideration. A.

539.19 : 535.343

387. EFFECT OF THE BASIC STRENGTH OF ATTACHED ROUPS ON LIGHT ABSORPTION SPECTRA. III DISSOCIATIONS THE EXCITED STATES OF NAPHTHALENE DERIVATIVES. .Itoh.
Phys. Soc. Japan, Vol. 13, No. 4, 389-94 (April, 1958).

Dissociations in the excited states of the derivatives of naphtha-ne, i.e., α- and β-naphthylamine, and α- and β-naphthol are dis-ssed by the molecular orbital treatment using the semi-empirical CAO method. The difference of the proton dissociation constant tween the excited and the ground state, pK_1-pK_2, is expressed by a rtain parameter connecting the Coulomb integral with the basic rength of attached groups. The value of the parameter is derived the light absorption spectra of the similar molecules. The calcu-ted values of the differences, pK_1-pK_2, are 5.0 and 5.5 in the case β-naphthylamine and α-naphthol in good agreement with the experi-ental values of 6.0 and 6.0 respectively. Similar calculations for naphthol give a considerably smaller value. A.

539.19

388. PARAMAGNETIC RESONANCE IN COPPER METHYLGLYOXIME. H.S.Jarrett.
chem. Phys., Vol. 28, No. 6, 1260-1 (June, 1958).

A single absorption peak was observed for all orientations of an diluted single crystal. The spectra show rhombic symmetry with = 2.136, g_x = 2.065, g_y = 2.033 ± 0.005, from which it is deduced at there is extensive mixing of the copper d_{xy} and nitrogen p bitals in the plane of the chelate. A.J.Manuel

539.19

389. RELATIVE SIGNS OF SPIN–SPIN INTERACTIONS IN UCLEAR MAGNETIC RESONANCE. S.Alexander.
chem. Phys., Vol. 28, No. 2, 358-9 (Feb., 1958).

The spectra of the vinyl protons in 3,3-dimethyl 1-butene and 1-butene have been analysed by assuming a set of relative signs the interactions and determining the best spin–spin and chemical ift parameters by a least-square fit. Calculated spectra for fferent sets of signs are presented, and the sets giving the best ts are seen by inspection. E.F.W.Seymour

539.19

390. EFFECT OF ENVIRONMENT ON THE FLUORINE AGNETIC RESONANCE IN SOLUTIONS OF POTASSIUM FLUORIDE. Carrington and T.Hines.
chem. Phys., Vol. 28, No. 4, 727-8 (April, 1958).

The chemical shifts of the fluorine nuclear magnetic resonance solutions of KF are found to be extremely sensitive to solvent, ncentration and temperature changes. Most of the reported results n be understood qualitatively if it is assumed that the polarization the fluoride ion by the solvent occurs principally through hydrogen nding; decreased bonding results in less polarization and therefore creased shielding of the nucleus. J.M.Baker

539.19

8391. N.M.R. CHEMICAL SHIFTS OF Pb^{207} IN A FEW COMPOUNDS. L.H.Piette and H.E.Weaver.
J. chem. Phys., Vol. 28, No. 4, 735-6 (April, 1958).

The chemical shift of the nuclear magnetic resonance of Pb^{207} in various compounds was measured. In ionic compounds the shift is ~ 1.4% due to diamagnetic shielding of the essentially spherical charge distribution. In partially covalent compounds the shift is reduced because the distortion of the charge cloud produced by bonding gives rise to a second order paramagnetic shielding. In a conductor, PbO_2, the shift is reduced further. J.M.Baker

539.19

8392. HIGH-RESOLUTION N.M.R. SPECTRUM OF LIQUID PROPANE. P.T.Narasimhan, N.Laine and M.T.Rogers.
J. chem. Phys., Vol. 28, No. 6, 1257-8 (June, 1958).

The proton resonance spectrum observed at 40 Mc/s is interpreted in terms of a chemical shift δ = 13.4 c/s and a spin–spin coupling constant J = 4.3 c/s between the protons of the CH_2 and CH_3 groups. An empirical relation between the value of δ and the electronegativity of the carbon atoms of the CH_3 groups is discussed. E.F.W.Seymour

539.19

8393. PROTON NUCLEAR MAGNETIC RESONANCE CHEMICAL SHIFTS. R.E.Glick and S.J.Ehrenson.
J. chem. Phys., Vol. 29, No. 2, 459-60 (Aug., 1958).

Values of atomic susceptibilities for H, C, N and O and structural correction terms for C=C, C=O, C=N and C≡C bonds are evaluated from recent values of the molar susceptibilities of various compounds, some of which have been newly measured by a resonance method (Abstr. 8065/1957). The structural correction terms correlate with the chemical shifts of the protons attached to the carbon atoms. E.F.W.Seymour

539.19

8394. EFFECTS OF IMPURITIES ON NUCLEAR QUADRUPOLE RESONANCE IN p-DICHLOROBENZENE.
S.Kojima, S.Ogawa, M.Minematsu and M.Tanaka.
J. Phys. Soc. Japan, Vol. 13, No. 5, 446-52 (May, 1958).

The resonance of Cl^{35} in α phase p-dichlorobenzene containing various impurities was studied. The impurities were p-BrϕCl, p-$Br_2\phi$, p-$I_2\phi$, p-OHϕCl, p-$CH_3\phi$Cl, p-$NH_2\phi$Cl, p-$NO_2\phi$Cl, p-$NO_2\phi CH_3$ and p-$(CH_3)_2\phi$. The characteristic number which represents the number of resonant nuclei which is affected by an impurity molecule was measured. This characteristic number depends on the volume difference of the resonant and impurity molecules and independent on the difference in dipole moment. Theoretical discussion supports the experiment. The height, width, shape and the integrated intensity of the resonance line were also measured. The integrated intensity was almost constant in the range of small concentration of impurity and then decreased. A.

539.19

8395. ELECTRON COUPLED INTERACTION IN SOLID IODINE. T.Itoh and K.Kambe.
J. Phys. Soc. Japan, Vol. 12, No. 7, 763-8 (July, 1957).

The hyperfine structure in the nuclear quadrupole resonance spectrum of solid iodine observed by Kojima, Ogawa, Hagiwara, Abe and Minematsu is analysed in terms of electron coupled interaction between nuclear spins. The theoretical expression for the Hamiltonian of the electron coupled interaction between two nuclei in an iodine molecule is derived, having the form of $JI_{Az}I_{Bz} + K(I_{Ax}I_{Bx} + I_{Ay}I_{By})$, where z is the bond axis. Electron coupled interactions between nuclei belonging to different molecules in the crystal are neglected. Values of the coupling constants J and K are determined to be both equal to 3.0 kc/s from comparison with the experimental data. The electronic structure of the chemical bond is discussed on the basis of the above coupling constants in combination with previously known quadrupole coupling constants. It is concluded that the bond in an iodine molecule has 22% s character and 33% d character. It is also concluded that there are auxiliary bonds between neighbouring molecules with a fractional importance of 10%. A.

539.19

8396. INFLUENCE OF TEMPERATURE ON THE PURE NUCLEAR QUADRUPOLE RESONANCE IN HEXACHLOROETHANE.
I.Tatsuzaki and Y.Yokozawa.
J. Phys. Soc. Japan, Vol. 12, No. 7, 802-8 (July, 1957).

The temperature dependence of the frequencies and the widths of absorption lines of pure nuclear quadrupole resonances were studied. The change of resonance frequencies with temperature is explained

as effect both of a torsional vibration of one end of CCl_3 groups with respect to the other end and of a rotational vibration of those groups as a whole around the C–C axis, the frequency of the latter vibration being changed with temperature owing to a thermal expansion of the lattice. The line-widths at half-maximum intensity were about 2 kc/s at temperatures of 77°K and 90°K, and about 10 kc/s at 196°K, although no absorption was detected at room temperature. The broadening of the resonance spectrum seems to be explainable by a reorientational motion around the C–C axis at much lower frequency than the resonance one. A.

539.19 : 535.343

MICROWAVE SPECTRUM OF BrCN AND DEPENDENCE OF QUADRUPOLE COUPLING CONSTANT ON THE VIBRATIONAL STATE. See Abstr. 7818

539.19 : 548.74

STRUCTURAL INVESTIGATION BY MEANS OF NUCLEAR QUADRUPOLE RESONANCE. See Abstr. 8532-4

539.19

8397. THE N_2O_4 MOLECULE AND A NEW TYPE OF CHEMICAL BOND. C.A.Coulson and J.Duchesne.
Bull. Acad. Roy. Belgique Cl. Sci., Vol. 43, No. 8, 522-32 (1957). In French.

The electronic structure of the N_2O_4 molecule is described in terms of molecular orbitals. In order to give account of the main facts, it is suggested that the N–N bond is a new sort of bond, a fractional π-bond, but without σ-character at all. It is called a "π-only bond". A.

539.19

8398. DETERMINATION OF THE O–O BOND ENERGY IN HYDROGEN PEROXIDE BY ELECTRON IMPACT. L.P.Lindeman and J.C.Guffy.
J. chem. Phys., Vol. 29, No. 1, 247-8 (July, 1958).

The mass spectrum of H_2O_2 and the appearance potentials of H_2O and H_2O_2 are tabulated and a value of 47.8 ± 3 kcal deduced for the dissociation energy of the O–O bond. G.I.W.Llewelyn

539.19

8399. IMPROVED MOLECULAR ORBITALS (COMPUTATIONS ON H_2). P.E.Phillipson and R.S.Mulliken.
J. chem. Phys., Vol. 28, No. 6, 1248-9 (June, 1958).

A great improvement is made in agreement with experiment of MO calculations on excited states of H_2 by using different effective charges for the AO's involved in different MO's. J.Hawgood

539.19

8400. ENTROPIES OF SOME DIATOMIC AND POLYATOMIC IONS. A.P.Altshuller.
J. chem. Phys., Vol. 28, No. 6, 1254-5 (June, 1958).

A compilation, with references, is given of interatomic distances, moments of inertia, gaseous entropies, partial molal entropies, and the entropies of hydration of some diatomic and polyatomic ions. W.Good

539.19 : 535.343

8401. MICROWAVE SPECTRUM, STRUCTURE, DIPOLE MOMENT, AND QUADRUPOLE COUPLING CONSTANT OF PROPARGYL CHLORIDE.
E.Hirota, T.Oka and Y.Morino.
J. chem. Phys., Vol. 29, No. 2, 444-5 (Aug., 1958).

The C–Cl bond length of $CH_2ClC{\equiv}CH$ is found to be normal (1.78 A) and the total dipole moment (1.68 D) is in good agreement with results obtained from dielectric constant determination. G.I.W.Llewelyn

539.19

8402. STUDIES ON THE RADIAL DISTRIBUTION ANALYSIS IN DIFFRACTION METHODS. I. ERRORS DUE TO THE APPROXIMATION OF INTEGRATION BY SUMMATION. T.Ino.
J. Phys. Soc. Japan, Vol. 12, No. 5, 495-9 (May, 1957).

In the calculation of a radial distribution function

$$rD(r) = (1/2\pi^2)\int_0^\infty sI(s)\sin sr\,ds$$

the integral is usually approximated by such a sum as

$$rD_\Sigma(r) = (\Delta s/2\pi^2)\sum_{n=1}^{x} n\Delta s\cdot I(n\Delta s)\cdot\sin(n\Delta sr).$$

In this paper the mathematical property of $rD_\Sigma(r)$ is derived and the error due to the approximation is proved to be expressed as

$$rD_\Sigma(r) - rD(r) = \sum_{\substack{m=-1\\ \neq 0}}^{\infty}{}' (r + 2m\pi/\Delta s)D(r + 2m\pi/\Delta s).$$

The formula for the estimation of the error is derived. In order to obtain a high accuracy from the approximation one must make the spacing Δs less than π/R_0, where R_0 is the distance beyond which rD(r) is regarded as practically zero. A

539.19

8403. STUDIES ON THE RADIAL DISTRIBUTION ANALYSIS IN DIFFRACTION METHODS. II. EFFECT OF NON-NUCLEAR SCATTERING AND ANALYSIS OF THE RADIAL DISTRIBUTION CURVE. K.Katada.
J. Phys. Soc. Japan, Vol. 13, No. 1, 51-8 (Jan., 1958).

An improved procedure is described for determining the molecular structures from electron diffraction data of gases by the radial distribution method. By this procedure the structural data can be straight-forwardly obtained from the radial distribution function derived from the observed intensity data without any assumption on the structure and disregard of the effect of non-nuclear scattering. The radial distribution function derived is the sum of the nuclear distribution function and the additional terms which have the same forms as the former. A method of the analysis of the radial distribution curve is developed by use of the moments of the distribution function. In addition, Karle and Karle's procedure is discussed and errors involved there are estimated. A.

539.19 : 537.311.33

8404. A SEMICONDUCTOR DETECTOR FOR SULPHUR AND SELENIUM MOLECULAR BEAMS. W.Gebhardt and O.Osberghaus.
Z. Phys., Vol. 150, No. 1, 33-7 (1958). In German.

The electrical resistance of semiconductors is markedly changed by doping with impurities. Cu_2O layers and CdS single crystals may be used as detectors of molecular beams of S and Se. The Cu_2O layers are more sensitive and reproducible, a measurement taking about 1 min. The minimum sulphur detectability using the Cu_2O layers is about 10^8 molecules of S_8 per cm^2 per sec. C.A.Hogarth

539.19

8405. THE PRODUCTION OF INTENSE MOLECULAR BEAMS OF NONCONDENSABLE GASES. EFFECTIVE CROSS-SECTIONS FOR THE COLLISIONS H_2–H_2 AND H_2–N_2.
A.Minten and O.Osberghaus.
Z. Phys., Vol. 150, No. 1, 74-9 (1958). In German.

Molecular beams of H_2 and N_2, of intensity 10^{15} molecules cm^{-2} sec^{-1} at 40 cm from the source, are obtained at low pumping speeds by using a new oven consisting of many parallel channels, each 25 mm long and 0.25 mm by 0.08 mm in cross-section, contained in a metal foil. Hence the collision diameters of such gases may be determined directly. R.Reed

539.19

8406. THE INTENSITY DISTRIBUTION OF VAPOUR AND MOLECULAR BEAMS. K.G.Günther.
Z. angew. Phys., Vol. 9, No. 11, 550-6 (Nov., 1957). In German.

An experimental study of the angular distribution of the intensity of molecules escaping from an orifice in a crucible, the experimental material being SiO, the thickness of condensed films of which is measured optically. The distribution is found to depend on the geometry of the orifice at low pressures, but with increasing pressure, when the mean free path becomes less than the orifice dimensions, the distribution is independent of orifice geometry. The experimental results are compared with theory. L.G.Carpenter

539.19

8407. INFLUENCE OF DISPERSION INTERACTIONS ON MOLECULAR PROPERTIES. L.Galatry.
C.R. Acad. Sci. (Paris), Vol. 247, No. 1, 65-8 (July 7, 1958). In French.

The idea of the self-consistent field is used in a calculation of the perturbation of the electronic wave-function of one molecule by its neighbours. This shows that the dispersion has very little effect on molecular structure in dense media, and that the usual approximation of constant polarizability is justified. J.Hawgood

539.19 : 541.12

8408. GENERALIZED BLOCH-TYPE EQUATIONS FOR CHEMICAL EXCHANGE. J.I.Kaplan.
J. chem. Phys., Vol. 29, No. 2, 462 (Aug., 1958).

These are for the interaction of molecular spin systems with their environment. Saturation, fast passages, hindered rotation and multiple radiation effects are obtained as relaxation terms where each nucleus is identified separately. The Bloch assumption of total spins is not satisfactory. P.Gray

539.19 : 539.12

409. POTENTIAL CURVES AND ENERGY LEVELS OF THE -MESO-MOLECULES $(pp)\mu$, $(dp)\mu$, $(dd)\mu$.
.Marschall and T.Schmidt.
. Phys., Vol. 150, No. 3, 293-8 (1958). In German.

In view of the fact that the Born—Oppenheimer approximation ay lead to large errors due to the largeness of the μ-mass, a new ethod is developed for the approximative calculation of potential irves and energy levels. The method was applied for the $(pp)\mu$, $p)\mu$ and $(dd)\mu$ molecules and the results are given. P.Roman

SOLID-STATE PHYSICS

539.2

410. THE ELECTRON MICROSCOPY OF CRYSTAL LATTICES. W.Menter.
dvances in Physics, Vol. 7, 299-348 (July, 1958).

A review of methods and results on the observation of crystal ttice periodicities and imperfections under the following headings:- resent position of instrument, surface methods of studying mole- ılar detail, observation of crystal lattices by direct transmission, idirect resolution of lattices by means of moiré patterns.

J.W.Menter

539.2

411. ANHARMONIC EFFECTS IN THE THEORY OF SOLID RGON. L.J.Zucker.
hil. Mag. (Eighth Ser.), Vol. 3, 987-98 (Sept., 1958).

The thermodynamic properties of solid argon are evaluated eoretically using the Debye quasi-harmonic theory and an Einstein eory modified to include anharmonic effects. The anharmonic eory gives better agreement with experiment except for the specific eat at low temperatures. A.

539.2

412. EQUATION OF STATE FOR SOLID ARGON. V.A.Kalinin.
Zh. éksper. teor. Fiz., Vol. 34, No. 1, 229-30 (1958). In Russian.

It is assumed that the potential energy per mole (E) of the rystal lattice depends upon the ratio (x) of the volume at a given emperature to the volume at the absolute zero according to the ormula

$$E = A\exp(-B\,x^{1/3}) - C/x^2$$

here A, B, C are constants. It is further assumed that the crystal omplies with Debye's theory and that the characteristic tempera- ure is in a fairly simple way related to x. The necessary empirical arameters are obtained from some of the available experimental ata. It is found that A = 8.000; C = 3.877 cal/mole and B = 13.078. ensity and thermal expansion coefficient are calculated for emperatures between 20 and 80° K and checked against the remain- ng experimental data. The agreement is good. R.Eisenschitz

539.2

413. EFFECT OF INHOMOGENEITIES OF THE CRYSTAL ATTICE ON THE THERMODYNAMICS OF A GAS OF QUASI- ARTICLES IN THE CRYSTAL. M.A.Krivoglaz.
h. éksper. teor. Fiz., Vol. 34, No. 2, 355-70 (1958). In Russian.

Various types of quasiparticles interacting among themselves r with static inhomogeneities of the crystal are considered. eneral formulae for the thermodynamic potential, valid for any type f particle and an arbitrary law of interaction, are obtained by erturbation theory methods under the assumption that the inter- ction energy is not large. As an example, an almost degenerate ermi gas of quasiparticles (metal electrons) interacting with the rystal defects is considered. Interaction of the conduction elec- rons with composition fluctuations leads in the case of alloys to a ependence of the electron part of the free energy, the electron hemical potential, thermoelectron emission current etc. on the ong and short-range order parameters. The magnitude of the order nergy related to the electron part of the free energy is approx- mately equal to the order energy observed experimentally. The ibrational part of the free energy was determined for solid sol- tions in which the masses of the atoms as well as their interaction nergy differ. A.

539.2

414. THE DIRECTION DEPENDENCE OF CRYSTAL ENERGY. .Döring.
nn. Phys. (Leipzig), Folge 7, Vol. 1, No. 1-3, 102-9 (1958).
n German.

Functions of the direction cosines are tabulated for each crystal lass such that each function is invariant for the symmetry operat- ions of that class. Properties like magnetic energy may be expressed in terms of these functions. A.R.Stokes

539.2

8415. POTENTIAL ENERGY FUNCTIONS FOR GRAPHITE. A.D.Crowell.
J. chem. Phys., Vol. 29, No. 2, 446-7 (Aug., 1958).

General expressions for interlayer spacing and compressibility are obtained for 6-12 and 6-exp potentials. Experimental and calculated results for cohesive energy are compared and values for parameters found, which agree well with those given by the Kirkwood—Muller formula. P.Gray

539.2

8416. REMARKS ON THE VIBRATIONS OF DIATOMIC LATTICES. A.A.Maradudin, P.Mazur, E.W.Montroll and G.H.Weiss.
Rev. mod. Phys., Vol. 30, No. 1, 175-96 (Jan., 1958).

Various aspects of the frequency spectrum of diatomic lattices and its dependence on perturbations (point defects, disorder, etc) are discussed. A review of the properties of the spectrum of a monatomic lattice is given, consisting, in particular, of a detailed discussion of the critical points of the distribution function. The effect on the frequency spectrum of the addition of a second type of atom into a simple cubic lattice is discussed, the resulting lattice being either an ordered diatomic lattice or one of various possible disordered two component lattices. Both these possibilities are discussed in detail. Of the various disordered two-component lattices, three extreme cases are discussed: (a) small numbers of B atoms in a matrix of A atoms; (b) slightly disordered lattices of A and B atoms; and (c) completely disordered lattices of A and B atoms. The work of Montroll, Maradudin and Weiss (Proceedings of the Many Body Conference. New York: Interscience Publishers Inc., 1958) on the analysis of localized modes is given in detail and the frequencies that come out of the top of the band of allowed frequencies when an impurity atom is inverted in the monatomic lattice are calculated. The effect on the frequency distribution when, in an ordered diatomic lattice, certain interchange between the A and B atoms takes place, is also given. A detailed discussion of the lattice vibrations of a disordered lattice is given and several well-known ingenious mathematical treatments are described. R.Bullough

539.2 : 548.735

SOME EMPIRICAL PROBLEMS CONCERNING ATOMIC BONDS. See Abstr. 7609

539.2

8417. ON THE INTERACTION BETWEEN ELECTRONS AND LATTICE VIBRATIONS. S.V.Tyablikov and V.V.Tolmachev.
Zh. éksper. teor. Fiz., Vol. 34, No. 5, 1254-7 (1958). In Russian.

Stability of the lattice taking into account the interaction between electrons and the phonon field is investigated. A stability criterion is derived which is not based on perturbation theory. A.

539.2

8418. INTERACTION OF CHARGED PARTICLES IN A DIELECTRIC. W.Kohn.
Phys. Rev., Vol. 110, No. 4, 857-64 (May 15, 1958).

This is a sequel to an earlier study (Abstr. 3474/1957), from a many-particle standpoint, of the motion of an electron (or hole) in an insulator. It considers an insulator (whose nuclei are taken as fixed), including the electron—electron interaction. It is then shown that the static dielectric constant κ defined in terms of the force between two distant point charges immersed in the medium, and the effective dielectric constant κ^*, which determines the force between an extra electron (or hole) and a distant point charge, are equal. These results may be summarized by the statement that, if sufficiently distant, external charges in a dielectric interact with each other and with the charge of an extra electron or hole as if all charges were renormalized according to the prescription $Q \to Q/\kappa^{1/2}$. The method of proof is to treat the Coulomb interactions between the electrons and between the electrons and external charges by perturbation theory and to establish a correspondence, to all orders, between the Feynman graphs which define κ and those which define κ^*. The result is therefore exact, at least as long as the perturbation series converge. A.

539.2

8419. NUMBER OF 3d ELECTRONS IN THE TRANSITION METALS. R.D.Deslattes.
Phys. Rev., Vol. 110, No. 6, 1471 (June 15, 1958).

It is suggested that Nilsson's observations (Abstr. 2685/1954) on the excitation function for K-series characteristic X-radiation from the transition metals support the conventional atomic 3d configurations rather than those recently reported by Weiss and DeMarco (Abstr. 3583/1958). D.M.Edwards

539.2

8420. COLLECTIVE VIBRATIONS OF ELECTRONS IN CRYSTALS. E.L.Feinberg.
Zh. éksper. teor. Fiz., Vol. 34, No. 5, 1125-37 (1958). In Russian.

Collective vibrations of electrons distributed with periodic density in a lattice are treated as quasihydrodynamic vibrations of a degenerate inhomogeneous electron gas. The properties of various levels are analysed. The probabilities of excitation of collective vibrations by light and by charged particles are presented. Quantitative estimations of the level spacing is compared with data on characteristic electron losses in thin layers. A.

539.2

8421. THE MEAN FREE PATH OF ELECTRONS IN VERY PURE TIN. B.N.Aleksandrov and B.I.Verkin.
Zh. éksper. teor. Fiz., Vol. 34, No. 6, 1655-6 (1958). In Russian.

The mean free path of electrons in a crystal of tin at 4.2°K was found to be 6.5×10^{-2} cm. S.Chomet

539.2

8422. NOTE ON: "THE BAND STRUCTURE OF ALUMINIUM: A SELF-CONSISTENT CALCULATION". R.E.Behringer.
J. Phys. Chem. Solids, Vol. 5, No. 1-2, 145-6 (1958).

Reports a systematic numerical error occurring in the paper by Heine of the above title (Abstr. 9294/1957). The estimated effect of the error is to lower all the energy levels by about 0.1 rydberg, but to shift them relative to one another by only about 0.03 rydberg. D.M.Edwards

539.2

8423. THE TEMPERATURE DEPENDENCE OF ENERGY LOSSES IN THE BAND MODEL OF SOLIDS. A.Schönhofer.
Z. Phys., Vol. 150, No. 1, 67-73 (1958). In German.

A one-dimensional crystal model assuming δ-potentials is used. The main part of the observed effects is due to electron-lattice vibration interactions and only a small part to phonon scattering. The general magnitude of the predicted effects agrees with experiment. The result for silicon is $\Delta E = 2.1\text{-}1.5 \times 10^{-3} T$ eV. C.A.Hogarth

539.2

8424. THE CONTACT OF ENERGY BANDS IN CRYSTALS. O.V.Kovalev and G.Ya.Lyubarskiĭ.
Zh. tekh. Fiz., Vol. 28, No. 6, 1151-8 (1958). In Russian.

The degeneracies of the energy levels in crystals connected with the space-group symmetry and time-reversal symmetry are considered. The space groups in which the energy bands touch or overlap, because screw axes or glide planes are present, are enumerated. The method of derivation differs somewhat from those previously used. K.F.Hulme

539.2

8425. PROPERTIES OF WANNIER FUNCTIONS. W.Kohn and S.Michaelson.
Proc. Phys. Soc., Vol. 72, Pt 2, 301-2 (Aug., 1958).

It is shown that for a one-dimensional Bloch problem, with a potential having a centre of symmetry, the Wannier function corresponding to an isolated energy band may be chosen so as to fall off exponentially. D.M.Edwards

539.2 : 535.39

8426. OPTICAL PROPERTIES OF DIAMOND TYPE CRYSTALS. M.Lax.
Phys. Rev. Letters, Vol. 1, No. 4, 131-2 (Aug. 15, 1958).

Mashkevich and Tolpygo (Abstr. 5461/1958) have proposed that a first-order electric moment exists in diamond type crystals, and that the observed spectrum may be associated with the fundamental optical vibration mode. These suggestions are criticized, and experimental evidence is quoted supporting the alternative proposition that the intrinsic part of the lattice vibration spectrum represents combination bands based on a second-order electric moment. B.T.M.Willis

539.2

8427. ON THE SHAPE OF LIGHT ABSORPTION AND DISPERSION CURVES IN MOLECULAR CRYSTALS DURING EXCITON FORMATION. A.F.Lubchenko.
Ukrayin. fiz. Zh., Vol. 2, No. 4, 310-21 (1957). In Ukrainian, with summaries (½ p.) in Russian and (½ p.) in English.

The shape of the curves is calculated, assuming weak coupling between electron excitation and lattice vibrations, by means of a perturbation method. A more detailed analysis is also made assuming the crystal to be a Debye continuum. C.R.S.Manders

539.2

8428. SOME OPTICAL EFFECTS OF PLASMA OSCILLATIONS IN A SOLID BODY. I.I.Sobel'man and E.L.Feinberg.
Zh. éksper. teor. Fiz., Vol. 34, No. 2, 494-500 (1958). In Russian.

Three optical effects involving "plasmons" (collective vibrations of electrons in a solid body) are considered: (a) excitation of a plasmon upon absorption of an X-ray quantum and its effect on the structure of the X-ray absorption edge, (b) Raman scattering on a plasmon, (c) absorption of light at the plasmon frequency. The cross-sections for all three processes are large. A.

539.2 : 535.39

8429. ON THE OPTICAL PROPERTIES OF METALS IN THE INFRARED REGION. V.P.Silin.
Zh. éksper. teor. Fiz., Vol. 34, No. 3, 707-13 (1958). In Russian.

Landau's theory of the Fermi liquid is employed to describe the optical properties of metals in the infrared region. The results obtained in this way differ significantly from those of the conventional electron theory of metals. A.

539.2 : 535.345

THE ABSORPTIVITY OF ANISOTROPIC METALS. See Abstr. 7826

539.2

8430. HYPERFINE INTERACTION AND ELECTRON SPIN RESONANCE IN POLARONS AND EXCITONS.
M.F.Deigen and S.I.Pekar.
Zh. éksper. teor. Fiz., Vol. 34, No. 3, 684-7 (1958). In Russian.

It is shown that in the first approximation the energy correction in polarons and excitons due to hyperfine interaction is equal to zero. Thus the width of the electron spin resonance in polarons and excitons due to the hyperfine interaction also vanishes. The narrowness of the electron spin resonance bands in metal–ammonium solutions is an additional proof that polarons are the current carriers. It is shown that the stationary concentration of excitons produced by intense illumination of a crystal may be so large that experimental detection of paramagnetic absorption in excitons may be possible. In virtue of the optical selection rules, excitons which absorb a radio quantum cannot be radiatively de-excited and hence their radiative lifetime should be large. A.

539.2 : 537.533.74

CYCLOTRON RESONANCE: METHOD FOR DETERMINING COLLISION CROSS SECTIONS FOR LOW-ENERGY ELECTRONS. See Abstr. 8049

539.2

8431. PARTICLE SIZE EFFECT ON NUCLEAR SPIN LATTICE RELAXATION TIME. D.A.Jennings and W.H.Tanttila.
J. chem. Phys., Vol. 28, No. 5, 976-7 (May, 1958).

The nuclear spin–lattice relaxation times of crystals and powdered KI were measured by a pulsed nuclear induction technique. At room temperature the relaxation times are the same, and at 4.2°K the relaxation time is twice as long in the powder as in the crystal. This is attributed to the fact that at the low temperature there are very few phonons in the powder at the nuclear resonance frequency. Hence the direct relaxation process, which is dominant in the crystal, is not operative in the powder. J.M.Baker

539.2

8432. QUADRUPOLAR BROADENED NUCLEAR MAGNETIC RESONANCE OF POLYCRYSTALLINE SOLIDS. D.E.O'Reilly.
J. chem. Phys., Vol. 28, No. 6, 1262-4 (June, 1958).

Absorption curves are exhibited for Al^{27} in polycrystalline αAl_2O_3 and in γAl_2O_3. Quadrupole broadening is present in both, but is more marked for γAl_2O_3, which has a high concentration of defects. For the latter the first and second moments agree with the calculated values assuming the theoretical value of γ_∞ for Al^{3+}. Some similar work was done on Na^{23} in sodium tungsten bronzes. D.J.Oliver

539.2

8433. MOLECULAR MOTION IN POLYPROPYLENE, ISOTACTIC AND ATACTIC. W.P.Slichter and E.R.Mandell.
J. chem. Phys., Vol. 29, No. 1, 232-3 (July, 1958).

Describes proton magnetic resonance and X-ray diffraction studies of these two forms of polypropylene, in particular the temperature dependence of the resonance line width and second moment. The isotactic form has amorphous and crystalline regions like polyethylene (Abstr. 407/1958), but the main chains are relatively immobile, most of the motion at lower temperatures being due to rotating methyl groups. J.Haywood

539.2

434. UNUSUAL TEMPERATURE DEPENDENCE OF BROMINE UADRUPOLE RESONANCES IN $TiBr_4$.
.G.Barnes and R.D.Engardt.
. chem. Phys., Vol. 29, No. 1, 248-9 (July, 1958).
The frequency of the Br^{79} resonance in solid $TiBr_4$ passes nrough a smooth maximum at about -50°C. This is shown to e consistent with the measured negative sign of the pressure oefficient of the frequency. E.F.W.Seymour

539.2

435. ON THE OVERHAUSER EFFECT IN NON-METALS.
.R.Khutsishvili.
h. éksper. teor. Fiz., Vol. 34, No. 6, 1653-4 (1958). In Russian.
An equation is given for the stationary nuclear polarization of on-metals. W.O.Lock

539.2

436. ON EXCESS VACANCIES IN GALVANICALLY DEPOSITED IETAL. Ya.E.Geguzin.
iz. Metallov i Metallovedenie, Vol. 5, No. 3, 536-44 (1957). n Russian.
Macroscopic pores were formed in electrodeposited copper by eating. The kinetics of change of vacancy concentration were tudied and found to be in agreement with the theory of Pines and eguzin (Zh. tekh. Fiz., Vol. 23, 11, 1953) by which the formation of xcess vacancies is related to release of microstresses in the attice. A.F.Brown

539.2

437. EFFECT OF EDGE DISLOCATIONS ON THE ALLOYING F INDIUM TO GERMANIUM. J.I.Pankove.
. appl. Phys., Vol. 28, No. 9, 1054-7 (Sept., 1957).
It has been observed that indium fused to germanium spreads nore extensively on material with a low edge-dislocation density nan on high dislocation density material. A detailed study of the lloying mechanism shows that: (1) edge dislocations and other crys-al disturbances enhance the dissolution of germanium in indium nence, under equilibrium conditions, deep alloying results with maller spread of the indium than in the case where the crystal is ree from these defects); (2) the recrystallized structure over an dge dislocation differs considerably from the structure at undis-urbed sites; (3) the shape of the alloy front is determined by surface ension forces and a tendency to terminate in (111) planes. A.

539.2 : 548.735

DIRECT OBSERVATION OF INDIVIDUAL DISLOCATIONS BY -RAY DIFFRACTION. See Abstr. 7607

539.2 : 538.114

THE DEPENDENCE OF COERCIVE FORCE ON THE DENSITY F DISLOCATIONS. See Abstr. 8112-13

539.2

438. THE VARIATIONS OF CRYSTAL STRUCTURE OF ALLIUM TELLURIDE (Ga_2Te_3) CAUSED BY DOPING WITH OPPER. G.Harbeke and G.Lautz.
Naturwissenschaften, Vol. 45, No. 12, 283-4 (1958). In German.
Doping in the region 8×10^{-6} to 10^{-5} atomic percent of Cu causes ignificant changes in the electrical conductivity. Doping above this evel causes in addition a strong infrared absorption in the range .8 to 3 μ and also changes the crystal structure. C.A.Hogarth

539.2 : 535.345

439. BEHAVIOR OF OXYGEN IN PLASTICALLY DEFORMED ILICON. S.Lederhandler and J.R.Patel.
Phys. Rev., Vol. 108, No. 2, 239-42 (Oct. 15, 1957).
The density of dislocations in silicon crystals is shown to have a marked effect on the annealing of the 9 μ infrared absorption band at 1000°C. (This absorption band was previously shown to be due to oxygen and to be dependent on the amount of oxygen present.) The annealing behaviour was studied in crystals grown from quartz crucibles and in samples where dislocations were introduced by plastic bending. For a deformed sample with a dislocation density of $10^7/cm^2$, the amplitude of the 9 μ band is reduced appreciably in 15 min at 1000°C, while the undeformed sample with a dislocation density of $10^4/cm^2$ requires about 12 hr. Preliminary light-scattering experiments in deformed and annealed samples show a definite anisotropy of the scattered intensity when the light vector is perpendicular or parallel to the dislocation lines. A.

539.2 : 537.311.31

440. RESISTIVITY OF INTERSTITIALS IN COPPER.
R.J.Potter and D.L.Dexter.
Phys. Rev., Vol. 108, No. 3, 677-82 (Nov. 1, 1957).
The residual resistivity of copper per atomic percent of interstitial atoms is computed in several different models. It is found that the contributions from the defect itself and from the associated lattice strain are of comparable magnitude and that the interference between them tends to reduce the resistivity. A shielded Coulomb potential, Blatt's computed phase shifts, and an electron—lattice interaction constant are variously used to calculate the scattering amplitudes. The necessary parameters are determined from high-temperature resistivity data. Values of about 2 μohm cm per atomic percent are obtained. A.

539.2

8441. HOLE BANDS IN CRYSTALS WITH NaCl-TYPE LATTICE.
T.I.Kucher.
Zh. éksper. teor. Fiz., Vol. 34, No. 2, 394-404 (1958). In Russian.
The energy as a function of the state of a NaCl-type cubic crystal with an electron removed (a hole) is considered in the Fock many-electron approximation under the assumption of strong interaction. It is shown that three hole bands exist which are contiguous at the point K = 0 which corresponds to a stationary (but not minimal) value of the energy of the crystal. The dependence of the energy, E, on K in the vicinity of the point K = 0 is not isotropic and is not of tensor nature. The band of light holes is important in conduction. This band has four absolute minima at the points $K\{\pm\pi/d; \pm\pi/d; \pm\pi/d\}$ and three relative minima at $K\{\pm 2\pi/d; 0; 0\}$, $\{0; \pm 2\pi/d; 0\}$ and $\{0; 0; \pm 2\pi/d\}$. Values of the effective masses at K = 0 are presented for various directions of K and the effective mass tensor for the aforementioned extermal points is written down. Numerical results are given for KCl. A.

539.2 : 535.33 : 537.531

CALCULATION OF THE STRUCTURE OF THE X-RAY EMISSION SPECTRUM OF ORDERING ALLOYS. See Abstr. 8020

539.2 : 537.311.33

8442. THE EFFECT OF STATIC INHOMOGENEITIES OF THE CRYSTALLINE LATTICE ON THE ELECTRONIC PROPERTIES OF A SEMICONDUCTOR. M.A.Krivoglaz and S.A.Rybak.
Zh. tekh. Fiz., Vol. 28, No. 5, 940-59 (1958). In Russian.
The inhomogeneities considered are those connected with fluctuations of composition, density, magnetization and other physical properties; their effect on the sum of states, mean free path, and mobility of conduction electrons is studied theoretically, using an isotropic continuum approximation. Attention is given to behaviour close to second-order phase-transitions, especially those in ferromagnetic semiconductors close to their Curie points. Solid solutions, antiferromagnetics and ferroelectrics are also considered. K.F.Hulme

539.2

8443. SYMMETRY PROPERTIES OF THE V_1 CENTER.
J.Lambe and E.J.West.
Phys. Rev., Vol. 108, No. 3, 634-7 (Nov. 1, 1957).
The symmetry of the V_1 centre was studied using a technique of bleaching with polarized light. The V_1 band in KCl and KBr produced by X-rays and 2-MeV electron bombardment was examined. In addition, the effect of bleaching with polarized light on the phosphorescent emission of KCl was observed. It is concluded that the centre responsible for the V_1 absorption band in KCl and KBr has cubic symmetry insofar as its optical absorption is concerned. The phosphorescent emission of KCl became anisotropic under polarized bleaching light, indicating the presence of a centre of noncubic symmetry. This second centre has a [011] axis of symmetry. A.

539.2

8444. PHOTOPRODUCTION OF V_1 CENTERS IN KBr CRYSTALS.
G.Chiarotti and N.Inchauspé.
Phys. Rev., Vol. 109, No. 2, 345-7 (Jan. 15, 1958).
KBr crystals were irradiated with monochromatic light of a wavelength of 190 mμ at liquid nitrogen temperature. When an electric field is applied to the crystal and its temperature subsequently raised, a burst of current is observed at -150°C, which corresponds to the destruction of V_1 centres. Evidence is presented that F centres and V_1 centres are created simultaneously by absorption of photons in the tail of the fundamental band of the crystal. A.

539.2

8445. THE FORM OF IMPURITY CENTRE LIGHT ABSORPTION AND EMISSION BANDS. A.F.Lubchenko.
Ukrayin. fiz. Zh., Vol. 1, No. 3, 265-80 (1956). In Ukrainian.
By calculating the mean radiation lifetime of an impurity centre in the excited state the change of form of the bands is established with respect to temperature and nature of solvents. The half-widths of the absorption and luminescent bands, symmetrical

with respect to the ordinate through the maximum value, are determined by purely analytical means. The limits of applicability of the "mirror symmetry" law are also considered.

C.R.S.Manders

539.2

8446. THE ABSORPTION AND EMISSION OF LIGHT BY IMPURITIES DURING EXCITATION OF THEIR LOCAL VIBRATORY LEVELS. A.F.Lubchenko.
Ukrayin. fiz. Zh., Vol. 1, No. 3, 281-93 (1956). In Ukrainian.

Mainly theoretical paper. The form is discussed of impurity absorption and emission bands during excitation of their oscillatory levels. Also studied are the transitions which are accompanied by change of number of the impurity local oscillations. It is shown that the separate impurity electron-oscillation bands and their variation with temperature and nature of solvent can be covered by the same analytical equations as for "electron-lattice" bands.

C.R.S.Manders

539.2

8447. THE THEORY OF F-CENTRES IN MIXED CRYSTALS. M.F.Deĭhen, O.A.Demʼydenko and Yu.V.Chkhartʼyshvili.
Ukrayin. fiz. Zh. Dodatok, Vol. 2, No. 2, 24-9 (1957). In Ukrainian with summaries ($\frac{1}{2}$ p. each) in English and Russian.

The F-band maximum position is calculated for mixed KCl–RbCl or KCl–NaCl mixed crystals, the amounts of RbCl or NaCl being small. An F-centre model is assumed where a host-crystal positive ion is replaced by an impurity ion and perturbation theory methods used for calculating the ground state and excited state energies. The possibility is shown theoretically of "anomalous" shift of F-band maximum, i.e. the frequency of the F-band maximum of KCl not shifting towards the F-band in pure RbCl or NaCl but in the opposite direction — a result in fact found with KCl doped with NaCl. C.R.S.Manders

539.2

8448. DEPENDENCE OF THE HYPERFINE STRUCTURE OF F-CENTRES ON THE ORIENTATION OF THE CRYSTAL IN AN EXTERNAL MAGNETIC FIELD. M.F.Deĭgen and V.Ya.Zevin.
Zh. éksper. teor. Fiz., Vol. 34, No. 5, 1142-7 (1958). In Russian.

The spin-Hamiltonian for the interaction between an F-centre electron and the angular momenta of the first and second coordinational spheres surrounding the nuclei were obtained by using the continuous and orbital models of F-centres in KCl-type lattices. The dependence of the frequency of spin-nuclear transitions on the orientation of the crystal in an external static magnetic field is considered. Comparison of theory with experiment leads to satisfactory agreement between the angular dependences and (to any order of magnitude) of the spin-Hamiltonian coefficients. The square of the F-centre wave-function in the potassium and chlorine sites of the lattice were determined by comparing with experiment. A.

539.2

8449. ANISOTROPY OF BOUNDARY MOBILITY.
S.Kohara, M.N.Parthasarathi and P.A.Beck.
J. appl. Phys., Vol. 29, No. 7, 1125-6 (July, 1958).

An Al single crystal was rolled (on a (110) plane in a [1$\bar{1}$2] direction) and recrystallization was induced by brief annealing at 350°C. This produced large numbers of those grains having the highest overall boundary mobility. Their orientations corresponded to 40° rotations around one of the two [111] axes common to the grains and the matrix. These grains were elongated in directions parallel to the common (111) planes, suggesting slow growth rates perpendicular to these planes. From the geometry this could imply that diffusion rates in twist boundaries (screw dislocations) are much lower than in boundaries made up of edge dislocations.

A.B.Lidiard

539.21

8450. FOCUSING IN COLLISION PROBLEMS IN SOLIDS. R.H.Silsbee.
J. appl. Phys., Vol. 28, No. 11, 1246-50 (Nov., 1957).

In treating problems of sputtering and radiation damage of solids, a billiard ball model is frequently assumed. An attempt is made to indicate to what extent such a model is justified. Using this model it is noted that the lattice structure of a crystal implies a correlation between successive collisions in a damage process which can lead to the propagation of an energy pulse, or a sequence of collisions, along a close packed line of atoms. The rate of attenuation of these pulses is estimated for a particular case and certain implications of the effect are discussed. A.

539.21

8451. ELECTRON IRRADIATION OF COPPER NEAR 10°K. J.W.Corbett, J.M.Denney, M.D.Fiske and R.M.Walker.
Phys. Rev., Vol. 108, No. 4, 954-64 (Nov. 15, 1057).

The resistivity change induced by electron irradiation of zone-refined copper maintained at ~ 10°K was measured over the range of bombarding electron energies from 0.70 to 1.37 MeV. The cross-section for damage production is shown to be insensitive to the choice of the shape of the displacement probability function for this energy range. An "average" threshold energy for displacement of 22 ± 3 eV is deduced, from which the resistivity of Frenkel pairs, $\rho_f = 1.45 \pm 0.5$ μohm cm/atomic % is obtained. Isochronal and isothermal annealing studies of irradiations performed at 1.37 MeV are described. The maximum annealing rate, as obtained from an isochronal anneal, occurs at ~ 40°K; ~ 90% of the irradiation-induced resistivity annealing out in the range 20°K-65°K. The isothermal annealing curves are not amenable to analysis in terms of a single simple rate process, but seem to require a multiplicity of processes. A.

STRUCTURE OF SOLIDS

539.211

8452. A SURVEY OF THE MATHEMATICS AVAILABLE FOR DESCRIBING FRACTURE. A.E.Scheidegger.
Canad. J. Phys., Vol. 36, No. 3, 300-8 (March, 1958).

An attempt is made to extend the mathematical finite-strain theory of general rheological bodies to the inclusion of discontinuous displacements, i.e. to the description of fractures and related phenomena. A general analytical representation of discontinuities is given. A particularly simple type of discontinuity has been singled out for special investigation, i.e. "dislocations". The notion of "dislocation" is investigated from the standpoint of finite-strain theory and several theorems are proved. Finally, the requirements for the establishment of a dynamic theory of fractures are outlined. It is shown that the mathematical theory cannot be carried further without additional physical investigations. The direction in which these have to be sought is indicated. A.

539.215.08 : 537.531

THE SMALL-ANGLE SCATTERING OF X-RAYS AND ITS USE FOR PARTICLE SIZE DETERMINATION. See Abstr. 8025

539.217

8453. ON SELF-DIFFUSION IN SILVER.
G.Airoldi and E.Germagnoli.
Energia nucleare, Vol. 5, No. 7, 445-8 (July, 1958).

The self-diffusion coefficient in silver was measured as a function of annealing temperature by means of radioactive tracing and sectioning techniques. A.

539.217

8454. DIFFUSION OF SILICON IN TRANSITION METALS.
G.V.Samsonov and L.A.Solonnikova.
Fiz. Metallov i Metallovedenie, Vol. 5, No. 3, 565-6 (1957).
In Russian.

Activation energies for diffusion of Si in Ti, Nb, Ta, Cr, Mo, W, α-Fe, γ-Fe, Co and Ni are tabulated (from new measurements) and compared with activation energies for diffusion of B, C, and N in the same metals. A.F.Brown

539.217

8455. GERMANIUM ARSENIDE AS DIFFUSION SURFACE COMPOUND. W.Waring, D.T.Pitman and S.R.Steele.
J. appl. Phys., Vol. 29, No. 6, 1002-3 (June, 1958).

As a means of investigating the chemical nature of surface layers produced by diffusing As into Ge, crystals of Ge and As mixtures of various compositions were prepared and examined by X-ray diffraction. The lines corresponding to GeAs and $GeAs_2$ were identified and crystallographic data of the compounds was calculated. Examination by electron and X-ray diffraction of Ge surfaces suggested that the p-type layer sometimes found when the As is diffused at high concentration results from a layer of GeAs with possibly a little $GeAs_2$. C.A.Hogarth

539.217

8456. INFLUENCE OF DOPING ON DIFFUSION RATE OF IMPURITIES IN CATHODE NICKEL. H.Mizuno.
J. appl. Phys., Vol. 29, No. 8, 1265-6 (Aug., 1958).

The effects of Mn impurities on the diffusion of Mg, and of Mg impurities on the diffusion of Mn in samples of cathode Ni are studied. It is found that increasing Mn concentration causes a

monotonic decrease in the diffusion coefficient of Mg in Ni, and that increasing Mg concentration causes a monotonic increase in the diffusion coefficient of Mn in Ni. C.H.B.Mee

539.217 : 539.371

ANALYSIS OF DIFFUSION IN MEDIA UNDERGOING DEFORMATION. See Abstr. 7561

539.219

8457. DIMENSIONAL CHANGES RESULTING FROM DEZINCIFICATION OF ALPHA BRASS.
W.J.Cooley and D.D.Van Horn.
J. appl. Phys., Vol. 28, No. 11, 1292-7 (Nov., 1957).

Small sheet and wire samples of high purity 70-30 brass were dezincified in vacuo at various temperatures, and the dimensional changes were observed as a function of the amount of zinc removed. The fractional changes in the dimensions normal to the diffusion direction were comparable to the changes in the diffusion direction. The dimensional changes were directly proportional to the amount of zinc removed and were independent of the temperature. The observed dimensional changes are explained as a combination of a net loss of lattice sites from the sample and the substitution of vacancies for zinc atoms at some of the other lattice sites. From the observed dimensional changes can be calculated both the ratio of diffusivities of copper and zinc atoms in the lattice and the effective size of the vacancies introduced. The ratio D_{Cu}/D_{Zn} is found to be 0.0832, and the volume dilation (fractional expansion per lattice fraction vacancies introduced) is −0.120. A.

539.219

8458. A NOTE ON TRANSITION METAL ALLOYS.
C.W.Haworth and W.Hume-Rothery.
Phil. Mag. (Eighth Ser.), Vol. 3, 1013-19 (Sept., 1958).

The composition limits of the different crystal structures found in the alloys of transition elements of Groups VA to VIIIC are discussed. The alloys of these elements give rise to phases with crystal structures of the σ, c.p. hexagonal, αMn, and βW types. The composition limits of these are often related to the group numbers of the constituent elements. If the equilibrium diagrams are drawn with the element of lower group number on the left, passage across the diagram from left to right results in the occurrence of different phases in the following order:

$$\text{b.c. cube} \rightarrow \beta W \rightarrow \sigma \rightarrow \alpha Mn \rightarrow \text{c.p. hex.} \rightarrow \text{f.c. cube.}$$

In all systems one or more of the above phases is absent, but the characteristic order is retained. In the alloys of elements of Group VIIIC with the elements in the middle of the transition series, there is a general tendency for the primary solid solution in the element of Group VIIIC to be greater than that in the element of the earlier Group, and an explanation of this is advanced. A.

539.23 : 537.521

8459. ON THE FORMATION OF THIN FILMS IN A SELF-MAINTAINING ELECTRIC GAS DISCHARGE IN A TRANSVERSE MAGNETIC FIELD. R.Haefer and A.A.Mohamed.
Acta phys. Austriaca, Vol. 11, No. 2, 193-220 (1957). In German.

The formation of thin films in a gas discharge was carried out for a series of gases including CH_4, SiH_4 and B_2H_6. The yield of material on the anode of the tube was measured. The thickness of the films was measured by observing their scattering power in the electron microscope. See also Abstr. 3808 (1954).
A.E.I. Research Laboratory

539.23

8460. STRUCTURE OF THIN Sn LAYERS. M.Oncescu.
Stud. Cercetări Fiz., Vol. 9, No. 1, 81-110 (1958). In Roumanian.

Determines the dependence of the specific resistance of a thin layer on its thickness and temperature, both for layers on a clean degassed supporting layer, and on a supporting layer previously "covered" (i.e. possessing Sn grains obtained by the granulation of a preliminarily deposited thin layer). Attempts are made at explaining the structure of the Sn layers involved. By using the Thomson—Fuchs formula, the author obtains the following values for the free path: 21 mμ for the clean degassed supports and 9 mμ for the covered support (58 mμ for tin in bulk). F.Lachman

539.23

8461. THE STRUCTURE OF POLYMER FILMS WHICH HAVE BEEN FORMED IN A GLOW DISCHARGE, IN DEPENDENCE UPON THEIR CONDITIONS OF FORMATION, AND ITS ALTERATION BY ELECTRON BOMBARDMENT. A.Brockes and H.König.
Z. Phys., Vol. 152, No. 1, 75-86 (1958). In German.

There is a likeness between the infrared absorption spectra of a polystyrene film which has been exposed to electron bombardment and of a polymer film formed by a glow discharge in a benzene atmosphere. Similarly, the infrared spectra of a polyethylene film after electron bombardment and the film formed by a glow discharge in methane are of the same type. Electron bombardment gives rise to cross-linking, and an increase in the voltage of the glow discharge produces similar changes in the infrared absorption spectrum as a bombardment of organic polymer films at very high electron densities. The mechanical stability of the polymer films was investigated by means of a replica technique with ZnO crystal needles which had been dissolved in dilute hydrochloric acid. It was found that the difference in the mechanical stability of the films produced by a glow discharge in benzene on the one hand, and in methane on the other lies in the longer treatment time for methane to produce films of similar thickness as in a benzene atmosphere. Replica films produced at higher voltages have greater mechanical stability and can therefore be used without subsequent electron bombardment.
R.Schnurmann

539.231

8462. POSITIVE-ION BOMBARDMENT OF GERMANIUM AND SILICON. S.P.Wolsky.
Phys. Rev., Vol. 108, No. 5, 1131-6 (Dec. 1, 1957).

A very sensitive vacuum microbalance was used to study the sputtering of germanium and silicon by argon ion bombardment. Current densities of 1 to 12 $\mu A/cm^2$ were used. The rates of sputtering of these materials were observed as a function of ion energy. A sputtering threshold energy of 46 eV was determined for germanium. The bombardment data are discussed in terms of the nature of the target surface. Oxidation data at 3 mm oxygen pressure are offered as evidence of the cleanliness of the bombarded surface. Approximately 10^{15} argon atoms/cm^2 were trapped or adsorbed by the target during the bombardment process. A.

539.231

8463. THE SPUTTERING OF CRYSTALS BY CANAL RAYS.
K.Thommen.
Z. Phys., Vol. 151, No. 2, 144-58 (1958). In German.

An experimental study of the sputtering from the (100) and (111) surfaces of Ge, FeS_2 and PbS single crystals by 8 kV Ne, A, Kr and Xe ion bombardment; for PbS, He also was used. The apparatus is described and the results are examined to determine the dependence of the sputtering on the condition and the crystallographic orientation of the surface and on the type of gas used. The results agree qualtitatively with Keywell's theory (Abstr. 4744/1955).
S.Weintroub

539.234 : 539.374

8464. DEFORMATION OF THIN FILMS ON SOLID SUBSTRATES.
D.R.Brame and T.Evans.
Phil. Mag. (Eighth Ser.), Vol. 3, 971-86 (Sept., 1958).

Thin films of various face-centred cubic metals in the thickness range of 300 to 700 A were oriented on single crystals of silver and palladium. These specimens were then deformed and the way in which the film accommodates the imposed strain was determined by examination of the film in the electron microscope after stripping from the substrate. It is considered that the mode of deformation is determined by the ease with which dislocations can be injected into and through the film from the underlying substrate and factors which influence this transfer were examined. A.

539.234

8465. INTERACTION BETWEEN AN ELECTRON BEAM AND THE SURFACE OF NaCl CRYSTALS. N.Croitoru and A.Gelberg.
Stud. Cercetări Fiz., Vol. 9, No. 1, 25-9 (1958). In Roumanian.

By electron bombardment of thin NaCl films, obtained by evaporation in a vacuum, the authors found (using metallographic and electron-microscopy methods) that the bombardment brings about changes in the geometrical structure of the surface.
F.Lachman

539.234

8466. THE INFLUENCE OF SURFACE FILMS OF FOREIGN SUBSTANCES ON THE STRUCTURAL CHANGES OF THIN EVAPORATED LAYERS OF METALS DURING ANNEALING.
K.J.Hanszen.
Z. Phys., Vol. 150, No. 5, 527-50 (1958). In German.

Films, 20-300 A thick, of silver, gold, copper and bismuth were prepared by evaporation on to foils of collodion, silicon monoxide, or carbon which were at room temperature. The metal films were observed in the electron microscope before and after tempering at various temperatures up to 800° C. An attempt was made to relate the observed changes in structure — aggregation, sublimation,

diffusion — to the influence of films of foreign substances. These may be formed by adsorption of residual gases during the evaporation process, or by spontaneous oxidation. The effect of carbon films, formed either by the influence of electron bombardment on the specimen or by deliberate deposition, was also investigated. In some cases the foreign films have a protective role, in other cases they promote structural changes, for instance by increasing the mobility of metal atoms on the surface, or by forming compounds with the metal which are more readily sublimed. V.E.Cosslett

539.234

8467. STUDIES ON HETEROGENEOUS EVAPORATED LAYERS OF ANTIMONY. E.Cremer and E.Ruedl.
Z. Phys., Vol. 151, No. 4, 487-503 (1958). In German.

When thermally evaporated layers of antimony are produced in a vacuum local patches appear and it is established that these represent a brown modification superposed on a blue modification. The brown type is more transparent than the blue. Transparencies are wavelength dependent and are the same for both modifications at 450 A. The thicknesses of the films were evaluated both by multiple-beam interference methods and also by a bronime titration method. There is very close agreement (mean deviation 4 A). Micro-resistance measurements are also reported. S.Tolansky

539.234

8468. PRODUCTION OF THIN FILMS OF ALUMINIUM WITH SHORT EVAPORATION TIMES. R.Gerharz.
Z. angew. Phys., Vol. 9, No. 2, 95-8 (Feb., 1957). In German.

Two methods are described for rapid evaporation to achieve high u.v. reflectivity: (a) a 10 μF condenser discharge at 25 kV was passed across a gap between Al electrodes, depositing Al on a glass substrate 25 mm away; (b) the same discharge was passed through an Al wire causing explosive vaporization. In each case evaporation was complete in about 0.2 sec. W.T.Welford

539.26

8469. STUDY OF PHASE TRANSITIONS IN WO_3 WITH A HIGH-TEMPERATURE X-RAY DIFFRACTOMETER.
J.A.Perri, E.Banks and B.Post.
J. appl. Phys., Vol. 28, No. 11, 1272-5 (Nov., 1957).

WO_3 undergoes a phase transformation from monoclinic to orthorhombic at approximately 320°C and from orthorhombic to tetragonal at 720°C. A detailed study of the variation of the unit cell dimensions over the range from room temperature to 1000°C was carried out using high-temperature X-ray diffraction techniques. Some unique features of the apparatus are described. Between the 320° and 720°C transformations, the a- and c-axes increase uniformly in length, while the b axis decreases. There is a marked increase in the volume of the unit cell below the orthorhombic to tetragonal transformation; the volume decreases sharply in the transformation and resumes its "normal" increase above 720°C. A.

539.26

8470. LOW-ANGLE X-RAY SCATTERING BY GLASSES.
E.A.Porai-Koshits and N.S.Andreyev.
Nature (London), Vol. 182, 335-6 (Aug. 2, 1958).

Evidence in the form of low-angle X-ray scattering is put forward for the existence of a chemically inhomogeneous structure in certain sodium borosilicate glasses. The exposure time was reduced by suitable heat treatment. Investigation of the untreated glasses would require prohibitive exposure times. T.Mulvey

539.26

8471. PRECISION X-RAY STUDIES ON ALLOYED GERMANIUM–INDIUM P–N JUNCTIONS. G.Mack.
Z. Phys., Vol. 152, No. 1, 26-33 (1958). In German.

The lattice parameter is found to be greater in the alloyed zone by 3 parts in 10^5. From this figure an In concentration of 6×10^{18} cm^{-3} is calculated, in agreement with estimates from the resistivity of Ge saturated with In. Line broadening and splitting are observed in the alloyed and the junction zones, and various causes, besides mosaic formation during recrystallization, are adduced. K.W.Plessner

539.26

8472. USE OF X-RAY SMALL-ANGLE SCATTERING FOR THE INVESTIGATION OF TECHNICAL PREPARATIONS. H.Knapp.
Z. angew. Phys., Vol. 9, No. 5, 233-9 (May, 1957). In German.

Describes the examination of alumina and lacquer pigments by the use of a modified Kratky small-angle camera. The modification consists of replacing the usual "parallel" beam by a divergent beam with one sharp edge. This simplifies the evaluation of the results and leads to the possibility of examining structures which lie outside the normal range of resolution of the method. J.Thewlis

539.26

8473. X-RAY DETERMINATION OF THE HETERO-DIFFUSION COEFFICIENTS IN ALLOYS, THE COMPONENTS OF WHICH HAVE WIDELY DIFFERING X-RAY ABSORPTION CHARACTERISTICS.
B.Ya.Pines and I.V.Smushkov.
Zh. tekh. Fiz., Vol. 28, No. 3, 661-7 (1958). In Russian.

If a specimen of a binary alloy constituting a substitutional solid solution, in which the concentration (c) of the two components varies with the distance (x) from its surface, is examined by the X-ray back-reflection technique, the intensity (dI) of the X-rays reflected by any particular layer (dx) of the specimen will also be a function of x. The authors discuss this relationship for the case when the two alloying components have different coefficients of X-ray absorption and different "reflective" characteristics. An equation combining dI with x is derived, its solution being obtained by the method of successive approximations. In addition to the function of concentration distribution c(x), the values of the concentration gradients dc(x)/dx across x are found directly, i.e. without differentiating the function c = c(x). From these values the coefficient of hetero-diffusion in relation to c can be calculated. Practical application of the proposed method is demonstrated using a Cr–Mo alloy.

M.H.Sloboda

539.26

8474. X-RAY DETERMINATION OF THE COEFFICIENTS OF HETERO-DIFFUSION IN THE CHROMIUM–MOLYBDENUM AND NICKEL–TUNGSTEN SYSTEMS. B.Ya.Pines and I.V.Smushkov.
Zh. tekh. Fiz., Vol. 28, No. 3, 668-73 (1958). In Russian.

With the aid of X-ray measurements (see preceding abstract) the coefficients of hetero-diffusion D in the Cr–Mo and Ni–W systems were determined on specimens obtained by electrodepositing layers of Cr and Ni on Mo and W respectively. The relationship between D and concentration of the components (c) was studied at 1100°, 1200°, 1300° and 1400°C in the Cr–Mo system, and at 900°, 1000°, 1100° and 1200°C in the Ni–W alloys. From the experimental data the concentration dependence of the activation energy Q(c) and the pre-exponential factor Do(c) were calculated for both systems. From the relationship Do = Do(c) the solution energy in the solid state $\tilde{U}o$ was determined. With the aid of $\tilde{U}o$ a theoretical equilibrium diagram of the Cr–Mo was constructed. The theoretical liquidus temperature agreed well with the experimental data. The value of $\tilde{U}o$ for the Ni–W system obtained from the relationship Do = Do(c) was of the same order of magnitude as that calculated from the constitution diagram of the system. It was found that in the Ni–W alloys, Do(c) changes its sign at the concentration corresponding approximately to the solid solubility limit. M.H.Sloboda

539.26 : 537.531 : 532.7

THEORY OF X-RAY DISTRIBUTION CURVES OF AMORPHOUS MATERIALS. See Abstr. 7743

539.27

8475. STUDY OF METALLIC CARBIDES BY ELECTRON DIFFRACTION. I. FORMATION AND DECOMPOSITION OF NICKEL CARBIDE. S.Nagakura.
J. Phys. Soc. Japan, Vol. 12, No. 5, 482-94 (May, 1957).

Thin nickel films formed by evaporation were carburized in a CO gas stream at temperatures from 250° C to 500° C and were studied by electron diffraction. Only Ni_3C was found to be formed. This has c.p.h. arrangement of nickel atoms with lattice constants a_h = 2.628 A and c_h = 4.306 A, but shows super-lattice reflections due to a hexagonal lattice of $a = \sqrt{3}a_h$ and $c = 3c_h$, which is considered to be caused by a regular arrangement of carbon atoms. The carbide was formed below 450° C in CO gas at a slow rate and decomposed rapidly above 430° C in vacuum. The rate of the carbide formation was highest at about 350° C, although it depended very much on the texture of nickel films. Hydrogen atmosphere did not alter essentially the stability of the carbide. It was found that nickel carbide is formed from metallic nickel with an epitaxial relation $(00.1)_{Ni_3C}//(111)_{Ni}$ and $[10.0]_{Ni_3C}//[10\bar{1}]_{Ni}$ (Ni_3C : c.p.h. indices) at the nucleation stage. A mechanism of the lattice transformation from metallic nickel to the carbide was suggested. This mechanism explains the epitaxy and its destruction in the growth stage of the carbide crystal. A.

539.27

8476. VARIATION OF ELECTRON DIFFRACTION INTENSITY WITH CRYSTAL SIZE. S.Kuwabara.
J. Phys. Soc. Japan, Vol. 12, No. 6, 637-43 (June, 1957).

Intensity of electron diffraction Debye–Scherrer rings was studied for evaporated films of Al, Ag, Au, NaCl, KCl and MgO of various thicknesses and crystal sizes. The observed intensity deviates from the value calculated by the kinematical theory of dif-

fraction at crystal sizes less than 100 A for all the materials examined. This result agrees with the conclusion of Blackman's dynamical theory. Yamzin and Pinsker's conclusion (Abstr. 4133/1950) that the kinematical theory can hold for films of thickness up to 500 A, apparently contradicts the present result. It is pointed out that Yamzin and Pinsker's conclusion resulted from the fact that they neglected the effect of the temperature factor. A.

539.27 : 538.221.08

8477. THE USE OF ELECTRON DIFFRACTION FOR MAGNETIC ANALYSIS. S.Yamaguchi.
Naturwissenschaften, Vol. 45, No. 1, 7-8 (1958). In German.

The passage of an electron beam through a magnetized body causes a deflection of the electron beam, and hence of the electron diffraction pattern compared with that, say, from gold. This effect can be exploited in the study of ferromagnetic materials in electron diffraction instruments. A.E.I. Research Laboratory

539.27

8478. AN ELECTRON DIFFRACTION APPARATUS WITH AN AUXILIARY ELECTRON BEAM FOR HEATING UP MASSIVE SPECIMENS. W.D.Riecke.
Z. wiss. Mikr., Vol. 63, No. 7, 427-49 (March, 1958). In German.

A diffraction attachment for the Siemens ÜM 100 electron microscope is described. The unit fits below the projector lens and is provided with two electron guns, one for heating the specimen and the other for removing electric charge from the specimen surface. A.E.I. Research Laboratory

539.27 : 771.531

8479. THE PROPERTIES OF PHOTOGRAPHIC EMULSIONS UNDER ELECTRON IRRADIATION. H.Frieser and E.Klein.
Z. angew. Phys., Vol. 10, No. 7, 337-46 (July, 1958). In German.

The aim of the work was to determine the optimum conditions for using photographic emulsions in electron microscopy. The different photographic effects of electrons and light quanta are compared, and the following properties of emulsions under electron irradiation are discussed: blackening curve, range and scatter of electrons in the emulsion, sensitivity and graininess. The results of the experiments are in good agreement with theory. B.T.M.Willis

ELASTICITY. STRENGTH. RHEOLOGY

539.32

8480. THE GENERAL RELATIONSHIPS BETWEEN THE ELASTIC CONSTANTS OF ISOTROPIC MATERIALS IN n DIMENSIONS. N.W.Tschoegl.
Austral. J. Phys., Vol. 11, No. 2, 154-7 (June, 1958).

The relationships between the elastic constants of homogeneous isotropic materials in n dimension are derived and are shown to depend on n. The maximal value of the generalized Poisson's ratio is $1/(n-1)$. The n-dimensional formulae reproduce the well-known three-dimensional relations $n = 3$, while $n = 2$ produces the relations appropriate for monomolecular films. The correct degeneration is shown for $n = 1$. A.

539.32 : 539.89

8481. ON THE INFLUENCE OF PRESSURE ON YOUNG'S MODULUS OF CERTAIN METALS.
A.D.Ekhlakov, V.A.Gladkovskiĭ and K.P.Rodionov.
Fiz. Metallov i Metallovedenie, Vol. 5, No. 3, 559-61 (1957). In Russian.

New measurements of the variation of Young's modulus with pressure $(1/E)(dE/dp)$ are reported at pressures up to 4000 kg/cm². The value of $(1/E)(dE/dp)$, as measured, is compared with the values of the same expression found by differentiating the formula $E = 9KG(3K + G)$ (K = compressibility, G = shear modulus) and using values of K and G found earlier at high pressures and reported in the literature. Good agreement is found for Al and steel, poor for Cu. A.F.Brown

539.32

8482. EFFECT OF HUMIDITY ON THE DYNAMIC MODULI OF NYLON 6-6 MONOFILAMENTS. B.A.Dunell and J.M.R.Quistwater.
J. chem. Phys., Vol. 29, No. 2, 450 (Aug., 1958).

Recent vibrational experiments in the humidity range from 11% to 95% at 35°C are supplemented by experiments at 60° C. The real and imaginary parts of the complex dynamic modulus, $E^* = E' + iE''$ are each reduced to a single "master curve" of E' or E'' v. reduced frequency. The empirically determined frequency reduction factors are plotted against the moisture sorption of the nylon for both 35° and 60° C. The fact that the reduction factors for both the real and imaginary parts of the complex dynamic modulus for both temperatures fall on a single curve is taken to indicate the existence of a time–humidity superposition principle of comparable character to the time–temperature superposition principle. B.J.Wilson

539.32

8483. THE FOUR ELASTIC CONSTANTS OF DIAMOND.
R.S.Krishnan, V.Chandrasekharan and E.S.Rajagopal.
Nature (London), Vol. 181, 518-20 (Aug. 23, 1958).

A re-evaluation is made for the elastic constants of diamond from the observed frequency shifts of the Brillouin components for the various orientations. Accuracy is estimated to be 3-5%. Agreement between experimental and calculated values of the frequency shifts is good. The results indicate that the interpretation of the experiments must be in terms of the atomic theory of elasticity due to Laval and Raman. The existence of the four elastic constants in diamond is definitely established. Young's modulus data for diamond would offer an additional test of the validity of the new theory proposed. S.Tolansky

539.32

8484. THE TEMPERATURE DEPENDENCE OF THE ELASTIC CONSTANTS OF ALKALI HALIDE CRYSTALS.
G.Liebfried and H.Hahn.
Z. Phys.,Vol. 150, No. 4, 497-525 (1958). In German.

The lattice free energy is calculated by considering the ions as independent oscillators each having the same frequency, dependent on the strain. The forces between ions are represented by Coulomb forces plus central short-range forces between nearest neighbours. A table of calculated and measured elastic constants is given, showing qualitative agreement. A.R.Stokes

539.32

8485. CALCULATION OF THE ELASTIC CONSTANTS OF A POLYCRYSTALLINE MATERIAL FROM THE ELASTIC CONSTANTS OF THE SINGLE CRYSTAL. E.Kröner.
Z. phys., Vol. 151, No. 4, 504-18 (1958). In German.

By the use of the concept of elastic polarizability an expression is obtained for the rigidity modulus of an aggregate of crystals of cubic symmetry, and comparisons with measured values are made. A.R.Stokes

539.37

8486. MECHANICAL CONDITIONING OF HIGH POLYMERS.
P.U.A.Grossman and R.S.T.Kingston.
Austral. J. appl. Sci., Vol. 6, No. 4, 442-52 (Dec., 1955).

A function of the ratio of irrecoverable strain to stress is introduced to describe the behaviour of a material subject to mechanical conditioning, where the principle of superposition is not applicable, and thus to extend the application of the theory of viscoelasticity. The relation between creep and stress relaxation is derived for three characteristic forms of this function, and it is shown that a comparison of creep and relaxation cannot furnish information on the existence of mechanical conditioning. A.

539.371 : 537.226.2

ELASTIC ANISOTROPY OF BARIUM TITANATE. See Abstr. 7887

539.373

8487. VARIATIONAL THEORY FOR FRICTIONAL SLIP IN THE CONTACT PLANE IN PLASTIC COMPRESSION. Liu Shu-I.
Scientia Sinica, Vol. 7, No. 4, 413-23 (April, 1958).

A study of families of friction-lines, defining the direction of slip at every point, on the supposition that the mechanical work done against friction is a minimum. J.G.Oldroyd

539.374 : 532.13

8488. THE VISCO-ELASTIC PROPERTIES OF NETWORK STRUCTURE. II. STRUCTURAL VISCOSITY. M.Yamamoto.
J. Phys. Soc. Japan, Vol. 12, No. 10, 1148-58 (Oct., 1957).

For Pt I see Abstr. 5459 (1956). The viscous bahaviours of concentrated polymer solutions are treated by making use of the model of a weak Gaussian network. If the chain-breakage coefficient, i.e. the probability of the breakage of a chain in the network, is independent of elongation of the chain, such a system shows the Newtonian flow. Proper choice of chain-breakage coefficient (for example, that of the square-well type) yields a typical rate dependence of viscosity; the larger the rate of shearing flow λ, the smaller the value of viscosity coefficient μ. Also considered is the tensile viscosity μ^* which in general increases with the rate of stretching λ^*, for small values of the rate. The so-called Trouton's formula $(\mu^* = 3\mu)$ is satisfied only in the limit of the zero values of λ and λ^*. A.

539.434 : 539.219

8489. ON THE ACTIVATION ENERGY OF DIFFUSION CREEP OF DISORDERED SUBSTITUTIONAL SOLID SOLUTIONS OF METALS. Ya.E.Geguzin.
Dokl. Akad. Nauk SSSR, Vol. 120, No. 4, 819-22 (1958). In Russian.

Starting from the premises that creep processes can be described in terms of self-diffusion of vacancies, it is shown that the activation energy of such processes in disordered substitutional solid solution (d.s.s.s.) of metallic components can be determined by three methods: (ii) From data on the temperature dependence of the coefficients of self-diffusion of the components of d.s.s.s. in a solution of a given concentration; (ii) from data on the heats of fusion of the components of the solution and on the value of $\Delta u_0 = u^1{}_0 - u^{11}{}_0$ (where $u^1{}_0$ and $u^{11}{}_0$ are the solution energies in the liquid and solid phases respectively), which can be determined from the equilibrium diagram of the system, and (iii) experimentally, from data on the temperature dependence of diffusion creep of a d.s.s.s. of a given concentration. Appropriate formulae are derived and it is shown that the values of the activation energy calculated for Au—Ni, Cu—Ni and Pb—Sn alloys are in good agreement with the results of a series of tentative experiments. M.H.Sloboda

539.434

8490. VOID NUCLEATION SITES IN CREEP OF METALS. P.W.Davies and J.P.Dennison.
Nature (London), Vol. 182, 131-2 (July 12, 1958).

High stress concentrations, which facilitate the nucleation of voids, could arise in a grain if a number of nearby screw dislocations of the same sign interacted to form steps at the boundary many atomic distances high. The proposed mechanism can be reconciled with the relative absence of voids in aluminium of very high purity, fractured under creep conditions, compared with less pure metals and alloys. J.G.Oldroyd

539.531 : 537.311.33

8491. MICROHARDNESS STUDY OF SOME ZINC-BLENDE-LIKE SEMICONDUCTORS. A.S.Borshchevskii, N.A.Goryunova and N.K.Takhtareva.
Zh. tekh. Fiz., Vol. 27, No. 7, 1408-13 (1957). In Russian.

The room temperature microhardnesses, M, of 17 polycrystalline semiconductors with sphalerite-, wurtzite- or diamond-type structures, were determined at loads of 10, 20, and 50 g. The dependence of M on purity was found to be unobservably small for InSb (up to ~ 10^{19} carriers/cm^3); only for GaAs was there any difference between the values of M obtained before and after etching a mechanically polished surface; only for CdSe (wurtzite-type) was there any apparent difference of M for different grains. It was found that in an isoelectronic series of compounds M decreased with increasing "ionicity" of the binding; this is in qualitative agreement with Goldschmidt's observations on the Mohs hardness of the same compounds. Metallurgical Abstracts

PHYSICAL CHEMISTRY

PHASE EQUILIBRIUM. CHEMICAL REACTIONS

541.12 : 530.162

8492. RANDOM WALKS AND DRIFT IN CHEMICAL DIFFUSION. A.D.Le Claire.
Phil. Mag. (Eighth Ser.), Vol. 3, 921-39 (Sept., 1958).

In self-diffusion the average displacement $\overline{X}(t)$ of an atom after a time t is zero. It is pointed out that in chemical diffusion $\overline{X}$ is not necessarily zero, for there are several mechanisms tending to make an atom jump preferentially in one direction rather than the other along a chemical concentration gradient, i.e. tending to produce a drift of atoms superimposed upon their otherwise random movement. This leads to a substantial modification of the classical Einstein equation $D = \overline{X^2}(t)/2t$ connecting the self-diffusion coefficient D with the mean square displacement $\overline{X^2}(t)$ and the equation for chemical diffusion which replaces it is derived. This is shown to lead, on the basis of a simple model, to Darken's equation for the chemical diffusion coefficient. Although in both this and a more general model there are usually two independent mechanisms contributing to $\overline{X}$, it turns out to be an interesting feature of chemical diffusion that only one of these is manifest in the chemical diffusion coefficient. The total drift $\overline{X}$ can be measured independently of the diffusion coefficient and values calculated from the theoretical expressions derived agree well with experimental measurements for zinc and for copper in α-brass/copper diffusion couples. The results are generalized for chemical diffusion in multicomponent systems and expressions obtained for the constants in the familiar schemes of equations used to describe multicomponent diffusion. It is concluded that the cross terms L_{ij} in the Onsager scheme are not primarily the result of correlation between the directions of successive jumps of atoms, as has been suggested. A.

541.123 : 539.18

8493. FRACTIONATION OF NITROGEN AND OXYGEN ISOTOPES BETWEEN GASEOUS NO AND LIQUID NOCl. L.B.Yeatts, Jr.
J. chem. Phys., Vol. 28, No. 6, 1255 (June, 1958).

Pure NO gas was contacted with pure NOCl liquid at −50°C. After 4 hr vigorous stirring both phases were sampled and the following values of the single stage fractionation factor α were obtained.

	$\alpha\ N^{14}/N^{15}$ 95% C.I.	$\alpha\ O^{16}/O^{18}$ 95% C.I.
1	1.017 ± 0.003	–
2	1.010 ± 0.006	1.013 ± 0.006
3	1.013 ± 0.003	1.011 ± 0.002

The experimental values of $\alpha - 1$ for the nitrogen exchange are about 50% of the calculated value. H.C.Cole

541.124

8494. ISOTOPIC EXCHANGE REACTIONS. III. THE SYSTEM $SiCl_4$—Cl_2. R.H.Herber and A.W.Cordes.
J. chem. Phys., Vol. 28, No. 2, 361-2 (Feb., 1958).

For previous work, see Abstr. 9939 (1957). No isotopic halogen exchange between Cl^{36}-labelled $SiCl_4$ and Cl_2 at 100° C was found after 71 hours. Exchange runs involving liquid $SiCl_4$ and gaseous Cl_2 at 0° C also failed to show any transfer of chlorine activity between the two reactants. W.Good

541.124

8495. REACTIONS OF METHYL WITH ETHYL RADICALS. C.A.Heller.
J. chem. Phys., Vol. 28, No. 6, 1255-6 (June, 1958).

The rate ratio of the combination reactions methyl—methyl, methyl—ethyl and ethyl—ethyl is calculated from mass spectrographic and (gas) chromatographic data. W.Good

541.124

8496. ENERGIES AND ENTROPIES OF ACTIVATION IN CHLORINE ATOM REACTIONS. P.Goldfinger, M.Jeunehomme and G.Martens.
J. chem. Phys., Vol. 29, No. 2, 456-8 (Aug., 1958).

These data are compiled for 17 chlorine atom reactions and a discussion is given of some unexpected features. W.Good

541.124 : 536.7

8497. THE THERMODYNAMICS OF DISSOCIATING EQUILIBRIUM MIXTURES IN AN EXTERNAL FIELD OF FORCE. W.Pauli.
Z. angew. Math. Phys., Vol. 9b, No. 5-6, 490-7 (1958). In German.

In the classical treatment of the dissociative equilibrium $I_2 \rightleftharpoons 2I$, the condition for chemical equilibrium is obtained by imagining that the reaction mechanism is magically suspended, thereby allowing the separation of the constituents by semi-permeable membranes. This artificiality is circumvented here by imagining that the reacting mixture can be pumped from a vessel in a magnetic field to one which is field-free. (The equilibrium concentrations differ in the two vessels because I is paramagnetic whereas I_2 is not). The major assumption now made is that the thermodynamics of the reaction is such as to maintain the constancy of the "magneto-chemical" potentials ($\mu_1(H) = \mu_1(0) - \frac{1}{2}\chi_1 H^2$) throughout the vessels. (χ_1, the susceptibility, is assumed to depend only on T). The known properties of the equilibrium mixtures are obtained and the results specialized to mixtures of ideal gases. R.O.Davies

541.126 : 535.379

8498. INFRARED CHEMILUMINESCENCE FROM THE GASEOUS REACTION ATOMIC H' PLUS Cl_2. J.K.Cashion and J.C.Polanyi.
J. chem. Phys., Vol. 29, No. 2, 455-6 (Aug., 1958).

Chlorine gas was passed through a sintered glass plate into an atmosphere of partially dissociated hydrogen at a total pressure of 0.2 mm. A recording infrared spectrometer with a 1.0 mm slit width recorded a strong emission at 2785 ± 15 cm^{-1} and a weaker one at 5500 cm^{-1}. These bands are due to the first overtone emission of HCl, shifted to longer wavelengths, suggesting that HCl is formed in a vibrationally excited state as a product of reaction and not by a secondary process involving HCl molecules. C.Turner

541.127 : 530.162

8499. BROWNIAN MOTION AND CHEMICAL KINETICS.
R.W.Zwanzig.
J. chem. Phys., Vol. 28, No. 2, 365-6 (Feb., 1958).

Using Montroll and Shuler's relaxation equation (Abstr. 7470/1957) and the Wigner distribution function (Abstr. 4441/1932), an equation is obtained for the perturbation of an initial distribution of quantum states during a chemical reaction. C.Turner

541.127

8500. KINETICS OF NITROGEN ATOM RECOMBINATION.
J.T.Herron, J.L.Franklin, P.Bradt and V.H.Dibeler.
J. chem. Phys., Vol. 29, No. 1, 230-1 (July, 1958).

The rate of recombination of nitrogen atoms in the presence of N_2 is found to be independent of temperatures between 195 and 453°K. The efficiences of N_2, A, and He as third bodies for the recombination reaction are in the ratios 10 : 6.1 : 1.5.
G.I.W.Llewelyn

541.127

8501. NITROGEN ATOMIC RECOMBINATION AT ROOM TEMPERATURE. T.Wentink, Jr, J.O.Sullivan and K.L.Wray.
J. chem. Phys., Vol. 29, No. 1, 231-2 (July, 1958).

Recombination rates were determined at pressures from 0.1 to 1.0 mm Hg in a nonflow system where the third body is the N_2 undissociated by an electrodeless discharge. Results are in good agreement with those of Herron et al. (preceding abstract) obtained on a flow system. G.I.W.Llewelyn

ELECTROCHEMISTRY

541.133

8502. TRANSFERENCE NUMBER IN BARIUM THIOCYANATE AND LEAD NITRATE BY A MOVING BOUNDARY TECHNIQUE.
J.N.Sahay.
Curr. Sci., Vol. 27, No. 7, 247-8 (July, 1958).

A convenient apparatus for measuring transference numbers by a falling boundary is described. By means of it the cation transference numbers in aqueous barium thiocyanate solutions are found to vary markedly and are insufficient for interpretation. In the case of lead nitrate, the agreement with Fall's data (J. Amer. Chem. Soc., Vol. 32, 1555, 1910) is satisfactory, but reasons are given to show that his calculations are incorrect. H.H.Hodgson

541.135 : 532.612.4

SURFACE TENSION OF STRONG ELECTROLYTES.
See Abstr. 7739

541.135.3

8503. DECOMPOSITION VOLTAGES OF SOME OXIDE SOLUTIONS IN CRYOLITE HEATED TO 1020°C. P.Mergault.
Ann. Phys. (Paris), Sér. 13, Vol. 3, No. 3-4, 179-229 (March-April, 1958). In French.

Previous work is reviewed, with a good bibliography, and its relation to the present work is emphasized. The descriptions of methods and apparatus go into careful detail. Graphite is used for the crucible and electrodes, which are heated by a 12 V alkaline battery. The temperature is measured with a Pt—Pt/Rh thermocouple. The method is basically graphical and results are given for Al, Cr, Mn, Fe, Co, Ni, Mo, W, Ti, Va, Nb, Te, U, and pure cryolite. P.Gray

541.135.4

8504. PROTON CONDUCTANCE IN ICE.
B.E.Conway and J.O'M.Bockris.
J. chem. Phys., Vol. 28, No. 2, 354-5 (Feb., 1958).

It is shown that (at −10° C) $(U_{H^+})_{water} = 3.3 \times 10^{-3}$ and $(U_{H^+})_{ice} = 1.9 \times 10^{-1}$ cm^2 sec^{-1} V^{-1}. This enhanced mobility of protons in ice may be interpreted in terms of a change in the rate-determining step, namely from water rotation to proton tunneling between H_3O^+ and H_2O and between OH^- and H_2O. W.Good

541.135.5

8505. MECHANISM OF THE ANODIC DISSOLVING OF MAGNESIUM. B.N.Kabanov and D.V.Kokoulina.
Dokl. Akad. Nauk SSSR, Vol. 120, No. 3, 558-61 (1958). In Russian.

Derives the theoretical value of the effective valency n_i of Mg on dissolving, based on two parallel processes: the anodic process $Mg^+ \rightarrow Mg^{2+}$ and the hydration of Mg^+. The equation obtained yields an S-shaped curve on the n_i/ϕ plot (ϕ = electrode potential), the inflection point of which is characterized by the same gradient as the inflection point on the experimental curve. The similar shapes of both curves seem to bear out the assumption that the process of anodic dissolving of Mg is composed of the diffusion process and of the slowed-down discharge. The authors conclude that the standard potential of the system Mg^+/Mg^{2+} is considerably more negative than the most negative potential (−1.4 V) at which Mg^{2+} is still produced on the anode. F.Lachman

PHOTOCHEMISTRY.

RADIATION CHEMISTRY

541.14

8506. ELECTRON SPIN RESONANCE OBSERVATIONS OF PHOTOCHROMIC SUBSTANCES. Y.Hirshberg and S.I.Weissman.
J. chem. Phys., Vol. 28, No. 4, 739-40 (April, 1958).

The authors were unable to observe any paramagnetic resonance absorption in a number of coloured products made by u.v. irradiation of compounds of bianthrone and spiropyran at low temperatures.
J.M.Baker

541.15

8507. OXYGEN EFFECTS IN THE RADIATION CHEMISTRY OF POLYETHYLENE. L.E.St.Pierre and H.A.Dewhurst.
J. chem. Phys., Vol. 29, No. 1, 241-2 (July, 1958).

Polyethylene films (0.3 mm thick) were irradiated to 10 Mr with 800 kVp electrons at a dose rate of 8×10^{20} eV g^{-1} min^{-1}. The percentage gel formation fell to almost 1/3 on increasing the oxygen pressure to 10 atm, and it is concluded that oxygen acts to inhibit the normal cross-linking reaction during the irradiation of polyethylene. J.R.Mallard

541.15

8508. RADIATION STABILITY OF LIQUID CYCLOOCTATETRAENE. S.Shida, H.Yamazaki and S.Arai.
J. chem. Phys., Vol. 29, No. 1, 245-6 (July, 1958).

Purified liquid cyclooctatetraene was irradiated in vacuo for several days with γ-rays from a 270 curie Co^{60} source at a dose-rate of 5300 r/min, total doses ranging from 30 to 50 Mr. It is shown that the material is one of the most radiation-stable organic liquids, especially with respect to gas production. J.R.Mallard

541.15

8509. RADIATION EFFECTS IN TWO ORGANIC SOLIDS.
R.G.Bennett, R.L.McCarthy, B.Nolin and J.Zimmerman.
J. chem. Phys., Vol. 29, No. 1, 249-50 (July, 1958).

Caproamide and caprolactam were irradiated with 2 MeV electrons. For caproamide the electron paramagnetic resonance spectrum indicates the formation of a free radical by the removal of a hydrogen atom from the carbon atom next to the C = O group. A deuterated compound showed the same effects after irradiation as the normal compound. In the case of caprolactam the spectrum of the deuterated compound differed significantly from that of the normal compound. J.R.Mallard

541.15

8510. BOMBARDMENT OF PLASTICS IN A GLOW DISCHARGE.
L.Holland.
Nature (London), Vol. 181, 1727-8 (June 21, 1958).

Perspex, polyethylene, polystyrene, epichlorhydrin resin cross-linked with melamine, and Fluon were bombarded in a glow discharge of 0.13 mA/cm^2 in air or argon. The anode was always damaged and became dark brown and opaque, whereas the cathode was sometimes degraded and appeared to have material removed as the surface became decomposed and the decomposition products were removed by sputtering. A.E.D.Heylen

DISPERSIONS. COLLOIDS. ADSORPTION

541.182.2/.3

8511. THEORY OF AEROSOL FILTRATION. S.K.Friedlander. Industr. engng Chem., Vol. 50, No. 8, 1161-4 (Aug., 1958).

The theory of operation of fibrous filters for the separation of particulate matter from gases is reviewed and extended. For this purpose impactation (or impinging) which describes deposition due to changes in direction of the gas, diffusion, and direct interception are considered. A method is then derived, based on an analysis of the diffusion equation, which will help in filter design and correlation of experimental data. H.H.Hodgson

CHEMICAL STRUCTURE

541.64

8512. TRIMERIC ASSOCIATION OF T-BUTANOL BY N.M.R. M.Saunders and J.B.Hyne.
J. chem. Phys., Vol. 29, No. 1, 253-4 (July, 1958).

The chemical shift of the hydroxyl hydrogen resonance in solutions of t-butanol in carbon tetrachloride was measured as a function of butanol concentration. The results are interpreted as evidence that the butanol exists predominantly as monomer and trimer with an equilibrium constant 5.6 l^2/M^2. E.F.W.Seymour

CHEMICAL ANALYSIS

545.827

8513. METHOD OF RADIOASSAY OF VOLATILE COMPOUNDS. R.H.Herber.
Rev. sci. Instrum., Vol. 28, No. 12, 1049-51 (Dec., 1957).

A rapid, convenient, and reproducible method was developed for the radio-assay of volatile materials labelled with beta emitters of > 0.15 MeV energy. The sensitive detection element is a thin-walled aluminium G.M. tube sealed into an annular jacket and attached directly to a high-vacuum manifold. Analysis data for $SiCl_4^{36}$ is presented, and application of the method to several tracer problems is suggested. A.

545.827

DETERMINATION OF THE HAFNIUM CONTENT OF ZIRCONIUM THROUGH AN ACTIVATION ANALYSIS. T.Stribel.
Z. angew. Phys., Vol. 9, No. 6, 293 (June, 1958). In German.

By neutron capture, Hf^{178} is turned into Hf^{179}, which is a 19 sec isomer decaying through a 215 keV γ-ray. This gives a means for determining the Hf content. The accuracy of this determination is at least one part in 10^{-5} by weight, under irradiation by a neutron flux of at most $10^7/cm^2$. G.E.Brown

CRYSTALLOGRAPHY

548.5 : 539.23

8515. THE GROWTH OF AN ORIENTED MONOLAYER OF LEAD ON A SILVER SINGLE-CRYSTAL SUBSTRATE. E.Grünbaum.
Proc. Phys. Soc., Vol. 72, Pt 3, 459-62 (Sept., 1958).

Electron diffraction patterns of Pb evaporated on Ag single crystals confirm Newman's conclusion (Abstr. 8926/1957) that in the first stage of growth, monolayer islands occur. The Pb deposit is then further built up as close-packed layers. J.Franks

548.51

8516. SUBLIMATION NUCLEI. G.A.Day.
Proc. Phys. Soc., Vol. 72, Pt 2, 296-9 (Aug., 1958).

Experiments to determine whether "sublimation nuclei" particles (Abstr. 3349/1956) retain their properties after prolonged drying are reported. The construction and operation of the apparatus — a freezing chamber maintained at -9^0 C and consisting of two concentric cylinders, an outer or evaporation section and an inner or humidifying section, and a detachable small cylinder forming an expansion gun — is described in detail. Results of tests with powdered iceland spar and Mt.Browne aerolite are shown graphically. It is concluded that iceland spar retains its nucleating properties for a longer time than naturally occurring particles in the atmosphere, but that the retention of a film of ice on the surface is limited to special circumstances and that after exposure for several minutes to humidities of 80-90% the evaporation appears complete. S.Weintroub

548.52

8517. SILICON CRYSTALS FREE OF DISLOCATIONS. W.C.Dash.
J. appl. Phys., Vol. 29, No. 4, 736-7 (April, 1958).

A method of growing crystals free of detectable oxygen and without observable dislocations is described. No crucible is used, but a Si disk placed on top of a Si pedestal inside a quartz chamber containing argon is melted by an external heater to wet the pedestal and to form a mound. A thin seed crystal is lowered into the mound and the required crystal withdrawn as in the Czochralski technique. To determine their dislocation content the crystals obtained were examined for etch pits, then sliced and the etched sections examined by decoration with Cu. S.Weintroub

548.55

8518. CASTING OF THIN SINGLE-CRYSTAL GERMANIUM PLATES. W.Bösenberg.
Z. angew. Phys., Vol. 9, No. 7, 347-9 (July, 1957). In German.

548.57

8519. CONICAL SPIRAL STRUCTURE AND LAMINAR CLEAVAGE OF GRAPHITE. T.Tsuzuku.
J. Phys. Soc. Japan, Vol. 12, No. 7, 778-88 (July, 1957).

Apparently circular crystals of graphite prepared from carbon black were investigated by an electron microscope. These crystals show circular growth patterns and produce spotty electron diffraction rings accompanied by ellipses and diffuse bands. Moreover, the circular crystal folded in half presents a fan-shaped appearance instead of a semi-circular form, i.e. two radii along the folded line makes an angle less than 180^0. These facts verify that the apparently circular crystal is really a stack of conical graphite sheets, each of which is successively rotated about the common axis in the c-direction. It is pointed out that such a conical crystal can be formed by a spiral mechanism. Laminar cleavage of conical crystals was observed, and the gliding mechanism connected with the spiral structure has been explained in terms of dislocations. From the spots distribution on the electron diffraction rings produced by some cleft sheets, the crystal was concluded to be in the form of a polygonal cone. A.

548.574

8520. ETCH PITTING ON SINGLE-CRYSTAL INDIUM ANTIMONIDE. R.E.Maringer.
J. appl. Phys., Vol. 29, No. 8, 1261 (Aug., 1958).

Certain aspects of the metallography of InSb were investigated as part of a programme on the electrical effects of plastic deformation in this compound. Etch pits on a single-crystal sphere confirm the validity of Allen's observations (Abstr. 1347/1958) and provide some additional information on the relationship between pit shape and surface orientation. W.Bardsley

548.574

8521. AN ETCHANT FOR GALLIUM ARSENIDE. D.N.Nasledov, A.Ya.Patrakova and B.V.Tsarenkov.
Zh. tekh. Fiz., Vol. 28, No. 4, 779-81 (1958). In Russian.

Plastically-deformed surface layers of polished n-type GaAs can be easily removed by etching for 5 min in a boiling solution of 50 ml. 5% NaOH + 10 ml. 30% H_2O_2. Etching rates of 10-15 μ/min are obtained with this etchant, which does not produce any undesirable side-effects, reveals the microstructure of polycrystalline specimens, promotes wetting of GaAs by Zn, In, Cd, Sn, Pb and Ag, and reduces the stray currents in GaAs p—n junctions. M.H.Sloboda

X-RAY CRYSTALLOGRAPHY

548.73/.74

X-RAY AND ELECTRON INVESTIGATION OF MATERIALS.
See also under "Structure of solids". Decimal classification 539.26/.27

548.732

8522. THE DIFFRACTION OF X-RAYS BY DIAMOND. I.
C.V.Raman.
Proc. Indian Acad. Sci. A, Vol. 47, No. 5, 263-75 (May, 1958).

This paper is concerned with fundamentals of diffraction of X-rays by crystals, and only incidentally with diamond structure. The inadequacies of the classical theory of diffraction are pointed out, and a discussion follows on the various modes of interaction of photons with the crystal lattice as a whole. A.R.Stokes

548.733 : 535.42

8523. A CRITICAL METHOD OF FOCUSING AN OPTICAL DIFFRACTOMETER. C.A.Taylor and B.J.Thompson.
J. sci. Instrum., Vol. 35, No. 8, 294-7 (Aug., 1958).

A simple but critical method of focusing the optical diffractometer is described. It depends on certain features in the intensity distribution near the focus in an error-free diffraction image of a circular aperture. Minor modifications to the optical diffractometer necessary to permit the application of the method are indicated. A.

548.733 : 534.26

ACOUSTIC ANALOGUE OF X-RAY DIFFRACTION BY A CRYSTAL. See Abstr. 7778

548.734.3

8524. THE PREPARATION OF POWDER SPECIMENS FROM ACTIVE AND TOXIC METALS FOR USE IN CONVENTIONAL X-RAY DIFFRACTION STUDIES.
A.Moore, D.B.Wright and A.J.Martin.
J. sci. Instrum., Vol. 35, No. 8, 301-3 (Aug., 1958).

An argon dry box and an associated procedure are described for the preparation of specimens for use in Debye–Scherrer powder cameras at high and low temperatures. Special features allow filings to be annealed at $> 1200^{\circ}$C, and quenched, if necessary, in vacuo: there is no need for filings to be sealed in a container for this purpose. Filings can be sealed in silica quills (~ 0.025 in. outside diameter and wall thickness ~ 0.005 in.) for use as specimen, by a small electrical furnace. The dry box is designed to enable an operator to be fully protected and to have fine control over the specimen at all stages of its preparation. A.

548.735

8525. COMPARISON OF TWO PROCEDURES FOR SOLUTION OF NONCENTRIC CRYSTAL STRUCTURES UTILIZING ANOMALOUS DISPERSION. R.Pepinsky and Y.Okaya.
Phys. Rev., Vol. 108, No. 5, 1231-2 (Dec. 1, 1957).

The authors' two formulations (see, for example, Abstr. 1754/1957) for direct solution of noncentric crystal structures via anomalous dispersion are compared, and it is demonstrated that use of the $P_S(u)$ function is in general superior to the method in which two or more simultaneous quadratic equations are used to determine phases of individual F_h and F_{-h} values. A.

548.735.4

8526. PRECISION MEASUREMENT OF THE LATTICE CONSTANT OF GERMANIUM SINGLE CRYSTALS BY KOSSEL AND VAN BERGEN'S METHOD. G.Mack.
Z. Phys., Vol. 152, No. 1, 19-25 (1958). In German.

Result given is $a = 5.657\,35 \pm 0.000\,05$ A at 20.00°C. Errors, corrections, and comparisons with other measurements by powder method are considered. A.R.Stokes

548.736 : 539.219

8527. X-RAY DIFFRACTION STUDY OF SOLID SOLUTIONS OF ALUMINIUM CALCIUM FERRITES.
A.I.Bolkova and E.A.Porai-Koshits.
Zh. tekh. Fiz., Vol. 27, No. 5, 1125-34 (1957). In Russian.

548.736.1

8528. DIFFUSE SCATTERING OF X-RAYS BY A POINT-IMPERFECTION IN DIAMOND LATTICE.
S.Yomosa and T.Nagamiya.
J. Phys. Soc. Japan, Vol. 12, No. 6, 610-17 (June, 1957).

The temperature independent diffuse scattering of X-rays by a diamond lattice, in which a few carbon atoms are missing or have been replaced by foreign atoms of valency four, is investigated. By the method given by Matsubara the intensity of diffuse scattering is calculated in terms of the force constants which are related to changes in bond length and of bond angle. The diffuse pattern observed by Lonsdale and Smith in natural diamonds are streak or spike type but the authors are of lemniscate type. These patterns may be observed in radiation damaged diamond crystals. A.

548.736.1 : 535.343 : 537.531

FINE STRUCTURES OF X-RAY ABSORPTION SPECTRA OF COBALT IN THE FACE CENTERED CUBIC LATTICE AND CLOSE-PACKED HEXAGONAL LATTICE. See Abstr. 8021

548.736.3 : 537.312.62

8529. STRUCTURE OF SUPERCONDUCTORS. XII. INVESTIGATION OF BISMUTH–RUBIDIUM ALLOYS.
N.N.Zhuravlev, T.A.Mingazin and G.S.Zhdanov.
Zh. éksper. teor. Fiz., Vol. 34, No. 4, 820-6 (1958). In Russian.

For Pt XI see Abstr. 1713 (1958). A provisional melting diagram of the Bi–Rb system is constructed on basis of thermal, microscopic and X-ray data. Four compounds were established for the Bi–Rb system. These are Bi_2Rb, $BiRb_3$ and the other two compounds are presumably Bi_2Rb_3 and $BiRb_2$. The superconducting compound Bi_2Rb crystallizes in the cubical system with $a = 9.609$ A and possesses a structure of the Cu_2Mg type. A.

548.736.3 : 537.312.62

8530. STRUCTURE OF SUPERCONDUCTORS. XIII. INVESTIGATION OF BISMUTH–CAESIUM ALLOYS. N.N.Zhuravlev.
Zh. éksper. teor. Fiz., Vol. 34, No. 4, 827-9 (1958). In Russian.

A provisional melting diagram of the Bi–Cs system is constructed. Three compounds, Bi_2Cs, $BiCs_3$ and one which probably is $BiCs_2$, were found. The superconducting compound Bi_2Cs crystallizes in the cubical system with a lattice constant $a = 9.746 \pm 0.005$ A and is isomorphic with the superconducting compounds Bi_2K and Bi_2Rb. A.

548.736.5

8531. PACKING OF CHAIN MOLECULES. II. LAYERS OF PARAFFIN MOLECULES. A.I.Kitaĭgorodskiĭ.
Kristallografiya, Vol. 2, No. 5, 646-52 (1957). In Russian.

The parameters and symmetry of possible layers in paraffin are deduced from the theory of the dense packing of molecules. R.F.S.Hearmon

548.74 : 539.19

8532. STRUCTURAL INVESTIGATION BY MEANS OF NUCLEAR QUADRUPOLE RESONANCE. I. DETERMINATION OF CRYSTAL SYMMETRY. K.Shimomura.
J. Phys. Soc. Japan, Vol. 12, No. 6, 652-7 (June, 1957).

The number of nonequivalent directions of the z-axes of the field gradient in the crystal for every symmetry class is calculated. It is shown that by Zeeman analysis of nuclear quadrupole resonance lines the symmetry of the crystal may be determined and also the orientations of nonequivalent directions with respect to the axes of symmetry. A.

548.74 : 539.19

8533. STRUCTURAL INVESTIGATION BY MEANS OF NUCLEAR QUADRUPOLE RESONANCE. II. TIN TETRABROMIDE.
K.Shimomura.
J. Phys. Soc. Japan, Vol. 12, No. 6, 657-67 (June, 1957).

Details of a universal quadrupole resonance crystal analyser are described, and using this apparatus the crystal structure of $SnBr_4$ was studied at room temperature (15°–20°C). The $SnBr_4$ molecule is an almost exact tetrahedron, and each of the four resonance lines is assigned to each bromine atom situated at the apexes of the tetrahedron, and the value of asymmetry parameter of the field gradient at the bromine nucleus is less than 0.025. The crystal has monoclinic symmetry and one of the Sn–Br bonds in one molecule is perpendicular to the b-axis and the other two orient at the same angle to the b-axis. All atoms, including Sn, in a molecule have nonequivalent general positions in the crystal, and the number of molecules in a unit-cell is equal to the maximum number of equivalent coordinates of the space-group. The existence of pairs of two molecules is suggested, and the origin of the splitting of the spectrum is discussed. $SnBr_4$ may be assigned to the symmetry class C_{2h}. The crystal symmetry of the low temperature phase is assigned to the cubic or hexagonal class. A.

548.74 : 539.19

8534. STRUCTURAL INVESTIGATION BY MEANS OF NUCLEAR QUADRUPOLE RESONANCE. III. ARSENIC TRIBROMIDE.
K.Shimomura.
J. Phys. Soc. Japan, Vol. 12, No. 12, 1386-93 (Dec., 1957).

The structure of $AsBr_3$ was investigated by means of nuclear quadrupole resonance at about 10°C, and compared with Braekken's results of X-ray analysis. $AsBr_3$ has the orthorhombic symmetry, and the Br–As–Br bond angles are $99^{\circ}38' \pm 16'$, $99^{\circ}14' \pm 18'$ and $102^{\circ}51' \pm 13'$. The polar angles specifying the directions of the As–Br bonds with respect to the crystal axes are ($62^{\circ}4' \pm 13'$,

56°9' ± 8'), (64°7' ± 15', −61°46' ± 11'), and (61°54' ± 8', 180°50' ± 20'). The bond angles are larger than those of Braekken by about 1°. The asymmetry parameter of field gradient at the bromine nucleus is about 0.04 ± 0.02. Single, double, and ionic character of As–Br bond are 61.4%, 1.2% and 37.4%, respectively, and the bond length is deduced to be 3.20 A. These results are consistent with those of X-ray analysis except the slight disagreement in the bond angles. A.

548.74

8535. STRUCTURE OF SOLID HELIUM BY NEUTRON DIFFRACTION. D.G.Henshaw.
Phys. Rev., Vol. 109, No. 2, 328-30 (Jan. 15, 1958).

Neutron diffraction patterns for six samples of polycrystalline solid helium were measured over the angular range from 5° to 62° using 1.06_4 A neutrons. Four of these specimens were held at 1.1_5°K and 66 atm, while the other two were maintained at 1.8_8°K and at 66 and 69 atm respectively. The diffuse scattering was small at low angles and increased with increasing angle up to 45°, beyond which the intensity decreased in much the same way as observed in the scattering patterns from liquid helium. Six lines were observed in the patterns recorded at 1.1_5°K and 66 atm. The position of the lines are fitted by a hexagonal close-packed structure in which $a_o = 3.53 \pm 0.03$ A and $c_o = 5.76 \pm 0.05$ A. Within experimental error no difference is observed between the patterns at 1.8_8°K and 1.1_5°K. The calculated density of solid helium at 1.1_5°K and 66 atm is 0.214 ± 0.006 g/cm^3. The mean isothermal compressibility of the solid at 1.1_5°K between the solidus and 66 atm is $(3.1 \pm 0.8) \times 10^{-3}$ atm^{-1}. A.

548.74

8536. SUPERSTRUCTURE IN THE ELECTRON DIFFRACTION DIAGRAM OF A MICA CRYSTAL. O.Rang.
Z. Phys., Vol. 152, No. 2, 194-202 (1958). In German.

It is shown that two mica layers superimposed with a relative rotation of 13.18° can be treated as a structure with a "virtual" unit cell larger than that of mica; electron diffraction photographs are interpreted in terms of this. A.R.Stokes

GEOPHYSICS

550.341

8537. THE TEMPERATURE GRADIENT NECESSARY FOR THE FORMATION OF LOW-VELOCITY LAYERS. P.E.Valle.
Ann. Geofis., Vol. 9, No. 3, 371-7 (July, 1956). In Italian.

It is supposed that low-velocity layers detected by seismic observations are due entirely to temperature gradients. The theory of this effect is developed and it is shown that a low-velocity layer can be produced in the asthenosphere if the temperature gradient is greater than 14 deg C/km (P-waves) or 11 deg C/km (S-waves). A.H.Cook

550.38 : 532.5 : 538.3

8538. GEOMAGNETIC DYNAMOS. A.Herzenberg.
Phil. Trans. A, Vol. 250, No. 986, 543-83 (1958).

The "dynamo theory" ascribes the origin of the earth's magnetic field to the dynamo action of motions in the conducting fluid of the earth's core. This paper supports the theory by proving rigorously that it is possible to postulate a pattern of motions in a sphere filled with conducting fluid in such a way that the arrangement acts as a dynamo producing a magnetic field extending outside the conductor. The equations of motion of the fluid are ignored. The proof is given for a model consisting of two eddies in the earth's core, and does no more than demonstrate that motions in a sphere filled with conducting fluid can act as a steady dynamo. It is certainly not suggested that the motions in the earth's core are so simple. There is nothing pathological about the relative orientations of the angular velocity vectors of the two eddies which lead to dynamo action; in fact about half of the possible relative orientations work. A.

550.385 : 537.591.5

MAGNETIC STORM EFFECTS AND INTERPLANETARY ELECTROMAGNETIC STATE. See Abstr. 8101

550.831

8539. A PROCEDURE FOR THE CALIBRATION OF GRAVIMETERS. M.Caputo.
Geofis. pura appl., Vol. 35, 8-13 (1956/III).

Taking into account some recent results showing that measurements made with Worden gravimeters are influenced by temperature, a method of calibration was devised which overcomes the effects of drift and ensures complete symmetry of every value observed. A.

ATMOSPHERE. METEOROLOGY

551.510.535

8540. EQUIVALENCE THEOREM ON THE WAVE ABSORPTION IN THE PLASMA. K.Rawer and K.Suchy.
Ann. Phys. (Leipzig), Folge 7, Vol. 1, No. 4-5, 255-60 (1958). In German.

An equivalence relationship between the absorption decrements of radiation incident perpendicularly, and at an angle to the ionosphere, is derived theoretically by wave and ray methods. Hence it is shown that Martyn's theorem is valid only if the absorption is predominantly determined by collisions, the absorption decrement is linearly dependent on collision frequency and the earth's magnetic field neglected. J.Dutton

551.510.535

8541. CALCULATION OF A CHARACTERISTIC VALUE FOR THE ABSORPTION IN THE IONOSPHERE FROM AN AUTOMATIC STATISTICAL ANALYSIS OF FIELD STRENGTH RECORDS. H.Schwentek.
Arch. elekt. Übertragung, Vol. 12, No. 7, 301-8 (July, 1958). In German.

An automatic apparatus is described which gives a frequency analysis of the field strength magnitude received by oblique reflection from the ionosphere. From these records the absorption values for the ionosphere can be calculated and this enables the state to be deduced. Diurnal variations are discussed and a simple formula suggested for the dependence of the diurnal variation on the sun's zenith angle. J.M.Hough

551.510.535

8542. LUNAR TIDES IN E2s AT BRISBANE. A.D.Gazzard.
Austral. J. Phys., Vol. 11, No. 2, 272 (June, 1958).

Analysis of two years h'E2s data has detected a lunar semi-diurnal variation of mean amplitude 1.5 km, with a maximum at 1.5 hr. G.M.Brown

551.510.535

8543. RESULTS OF THE DETERMINATION OF ELECTRON CONCENTRATION IN THE OUTER REGION OF THE IONOSPHERE FROM OBSERVATIONS OF THE RADIO SIGNALS FROM THE FIRST SPUTNIK.
Ya.L.Al'pert, F.F.Dobryakova, É.F.Chudesenko and B.S.Shapiro.
Dokl. Akad. Nauk SSSR, Vol. 120, No. 4, 743-6 (1958). In Russian.

Observations of the "rising" and "setting" at 40 Mc/s of the first sputnik were used to obtain data at six points on October 5, 6, 7, 1957. Results are tabulated. G.A.Chisnall

551.510.535

8544. IONOSPHERIC h'f-OBSERVATIONS OBTAINED DURING THE PERIOD OF THE SOLAR ECLIPSE OF 30th JUNE 1954.
B.Landmark, F.Lied and S.Skribeland.
Geofys. Publ., Vol. 19, No. 8, 5-28 (1956).

Measurements were made at three different stations (Kjeller, Tromøya and Tromsø). In interpreting the results it is assumed that only the recombination of the free electrons is of importance, and consequently de-ionization by other mechanisms is not taken into account. With these assumptions it is shown that the obtained results cannot be explained in terms of a uniform distribution of the ionizing agency over the sun's disk and a solar model has been postulated to give a better agreement with observed and calculated curves. Values of the recombination coefficient α have been deduced for E-, F1- and F2-layers. With regard to the F2-layers it is found that at a period around maximum eclipse the observations can only be explained in terms of a marked solar control of the ionizing agency. A smaller dip, observed at all three stations some time before the optical eclipse, may possibly be explained in terms of a corpuscular eclipse. A.

551.510.535

8545. IONOSPHERIC ABSORPTION DURING THE ECLIPSE OF 30th JUNE 1954. F.Lied and T.Orhaug.
Geofys. Publ., Vol. 19, No. 8, 29-35 (1956).

Measurements of ionospheric absorption made at Kjellèr and Tromøya have shown very clearly the effect of this. Measurements made with variable-frequency equipment have proved easier to interpret than have similar measurements made on a fixed frequency. A solar "model" based on F1-layer observations leads to results more in line with the observed absorption, than does a model which assumes a uniform distribution of ionizing radiation over the sun's disk. A value of 13×10^{-4} is obtained for αN_0, which compares reasonably with the value of 8×10^{-4} obtained by considering the delay between local noon and maximum absorption at Kjeller. A.

551.510.535

8546. AN IONOSPHERIC LAYER DURING A SOLAR ECLIPSE. F.Lied.
Geofys. Publ., Vol. 19, No. 8, 37-9 (1956).

The changes in electron density and non-deviative absorption for an ionospheric layer were calculated for the eclipse of 30 June 1954 at Kjeller. The recombination coefficient and the collision frequency have been taken from published results. A comparison is made between the normal approximate method of analysing eclipse observations, and the more detailed treatment given here. A.

551.510.535

8547. CONCERNING IONOSPHERIC TURBULENCE AT THE METEORIC LEVEL. H.G.Booker.
J. geophys. Res., Vol. 63, No. 1, 97-107 (March, 1958).

Booker (Abstr. 5539/1958) and Booker and Cohen (Abstr. 4640/1958) have given reasons for thinking that application of fluid mechanics to meteoric phenomena leads to results in discord with previous thought. This has led to a discussion (Abstr. 4641/1958) that is continued in this paper. An underlying feature of the discussion is a phenomenon that may be described as the "rough trail paradox". This arises from the fact that the turbulence velocity of the large eddies is about ten times greater than the turbulence velocity of the small eddies. For a trail that has been rendered rough by the small eddies, the echoes from two points, separated by a distance of the order of the large eddy size, are examined. Due to the motion of the large eddies, interference between these two points is taking place at a rate ten times faster than the rate at which the phase of the echo from either point is taking up random values due to the motion of the small eddies. The outcome is that the most obvious features of the fading of long-duration meteor echoes are controlled by the motion of the large eddies even when the mechanism of return is backscattering associated with the small eddies. Failure to appreciate this point seems to have led Manning and Eshleman (Abstr. 4641/1958) to claim as an antithesis to the Kolmogoroff–Heisenberg theory of turbulence results that, in fact, are consistent with it. A.

551.510.535 : 532.5 : 538.3

8548. MAGNETO-HYDRODYNAMIC WAVES IN THE IONOSPHERE AND THEIR APPLICATION TO GIANT PULSATIONS. B.Lehnert.
Tellus, Vol. 8, No. 2, 241-51 (May, 1956).

In magnetohydrodynamics conservation of energy leads to the adiabatic relation, $du = pd\rho/\rho^2$, between the internal energy u per unit mass, the pressure p, and the density ρ. The relation is valid for arbitrary amplitudes in a non-dissipative medium. The Hall current modifies the properties of magnetohydrodynamic waves in an ionized gas. The compressive modes and the Alfvén mode earlier discussed by van de Hulst are shown to be coupled by means of the Hall current. The dissipation of slightly damped waves is expressed in terms of the effective conductivity $\sigma_3 = \sigma_1 + \sigma_2^2/\sigma_1$ earlier introduced by Cowling. The theory is applied to magnetohydrodynamic oscillations in the layers of the ionosphere. The possible periods of the waves are consistent with the periods of "giant pulsations" which have been observed as a type of perturbation in the earth's magnetic field in the auroral zone. The results indicate that magnetohydrodynamic waves in the E-, F1-, and F2-layers may explain the existence of giant pulsations as well as the occurrence of rapid vibrations in the terrestrial magnetic field. A.

551.510.535

8549. CALCULATION OF TRUE HEIGHTS OF ELECTRON DENSITY IN THE IONOSPHERE. N.Ganesan.
T. Ned. Radiogenoot., Vol. 22, No. 5, 277-91 (Sept., 1957).

Curves were obtained showing the variation of the virtual heights of reflection with frequency for a linear layer. With the help of these curves a number of h', f records were reduced to those of electron density as a function of true height. The effect of the earth's magnetic field was taken into consideration in these calculations. This method seems to be accurate, as such curves reduced in this manner were found to agree with the actual data of electron densities at various heights obtained during the several rocket flights carried out over White Sands, New Mexico. All computations are for vertical propagation. A.

551.510.535

RADIO-WAVE PROPAGATION IN THE IONOSPHERE. See also under "Electromagnetic waves and oscillations". Decimal classification 538.566.3

551.521.1

8550. MEASUREMENT OF THE DARKENING OF THE SUN DURING AN ECLIPSE. W.Schüepp.
Tellus, Vol. 9, No. 2, 238-49 (May, 1947). In French.

Measurement of solar radiation in 7 monochromatic regions, and measurements of total, diffuse and direct radiation, during the partial eclipse of 25 February 1952 at N'dele (8°24' 25" N, 20°40' 0" E) lead to a determination of solar limb darkening, even for the region between 99 and 100% of the sun's radius. The values of Minnaert (1953) and Peyturaux (1952 and 1955) are confirmed; the formula of Houtgast (1952) is shown to be incorrect. This confirms the idea of Plaskett (1936) that there must be a very strong temperature gradient near the surface of the photosphere. Using the new formula from Warzee (1955) the constants for total radiation are computed and compared with the radiative equilibrium and with the case of a mean wavelength of 548.5 mμ. The difference in the case of 548.5 mμ is due to the fact that the centre of the sun's disk is bluer, and the border region redder, than this wavelength. A.

551.521.3

8551. CORRELATION OF ATMOSPHERIC TRANSMISSION WITH BACKSCATTERING. J.A.Curcio and G.L.Knestrick.
J. Opt. Soc. Amer., Vol. 48, No. 10, 686-9 (Oct., 1958).

This is a report of experimental work performed during the period of September 1956 to June 1957 on the correlation of backscattering with atmospheric transmission. Measurements were made for a variety of conditions where the meteorological range varied from less than 0.10 mile to more than 40 miles in atmospheres which were free of industrial pollution. Analysis of the data shows the following relationship:

$$V = C/S^{1.5},$$

where V = meteorological range, C = constant, and S = backscattered signal. The point spread about the curve indicates that meteorological range can be determined from the backscattered signal with an accuracy of 20% for all visibilities in the ranges studied. A.

551.521.3

8552. A SIMPLE DEVICE FOR OBSERVING THE POLARIZATION OF LIGHT FROM THE SKY. U.Halldén.
Nature (London), Vol. 182, 333 (Aug. 2, 1958).

Describes the construction of a 12-sector radial analyser made from Polaroid sheet and combined with a radial retarding plate formed from superimposed layers of Cellophane tape. This assembly is simpler to construct, and more sensitive than the device described by Chapman (Abstr. 6545/1958). D.R.Barber

551.524

8553. MEASUREMENTS OF FLUCTUATIONS OF ATMOSPHERIC TEMPERATURE. A.W.Adey and W.J.Heikkila.
Canad. J. Phys., Vol. 36, No. 6, 802-4 (June, 1958).

The sensing elements were platinum resistance thermometers, of 2.5μ diameter wire and either single-looped (100 ohms) or multi-looped (600 ohms), with a measured time constant of 1 msec. Results for fluctuations at a point are presented, the atmosphere having been sampled from platforms at several levels on a 64-metre tower and with the element ~ 10 ft from the tower. The block diagram of the equipment for spectrum measurements is shown together with sample records. The r.m.s. temperature fluctuation per unit bandwidth plotted as a function of frequency f approximates to a const/f line. S.Weintroub

551.574

8554. CLOUD PHYSICS RESEARCH IN SOUTH AFRICA. S.C.Mossop and A.E.Carte.
S. African J. Sci., Vol. 53, No. 11, 293-7 (June, 1957).

Field studies of methods of artificially stimulating rain have shown that a much greater knowledge of the fundamental physics of rain-clouds is necessary before predictable results are possible. Research is therefore being carried out by the National Physical Research Laboratory, Pretoria, on the spontaneous freezing of

water, the nature and concentration of atmospheric freezing nuclei and hygroscopic nuclei. The progress of this work is outlined. A.

551.574.1 : 533.15

8555. ON THE DETERMINATION OF THE DIFFUSION COEFFICIENT OF CONDENSATION NUCLEI USING THE STATIC AND DYNAMIC METHODS. L.W.Pollak, T.C.O'Connor and A.L.Metnieks. APPENDIX. R.Fürth.
Geofis. pura. appl., Vol. 34, 177-92, 192-5 (1956/II).

Diffusion coefficients were determined by measuring the rate of disappearance of condensation nuclei in a closed vessel (static method), and the loss of nuclei from air passing through a thin rectangular channel (dynamic method). A new type of decay vessel was developed which improved the accuracy of the static experiment, and the results were internally consistent. The results obtained by the dynamic method were found to depend markedly on the air flow velocity, and to a lesser extent on the humidity. The discrepancy between the results obtained by the two methods can be removed if the influence of a thin boundary layer 1.5 mm thick is included in the theory of the static method. G.M.Brown

551.594.14

8556. ANNOTATED BIBLIOGRAPHY ON RADIOACTIVITY IN THE ATMOSPHERE (SUPPLEMENT). G.Thuronyi.
Meteorol. Abstr., Vol. 9, No. 3, 324-66 (March, 1958).

This bibliography is a supplement to one published earlier (Abstr. 1807/1957). The primary subject of this supplement, as of the original bibliography, is the radioactivity of fission products in the atmosphere, its distribution in space and time, its measurement, computation and prediction. Again, as in the earlier bibliography, this principal subject was supplemented by reference to literature in peripheral fields like non-radioactive effects of nuclear weapons, natural radioactivity of the atmosphere, etc. No attempt was made either in the original bibliography or in this supplement to cover the available literature on natural radioactivity in the atmosphere systematically. The period covered (with very few exceptions) is that of 1955-58. A.

551.594.221

8557. THE RELATION BETWEEN THE NUMBER OF STROKES, STROKE INTERVALS AND THE TOTAL DURATIONS OF LIGHTNING DISCHARGES. D.J.Malan.
Geofis. pura appl., Vol. 34, 224-30 (1956/II).

Although lightning flashes have been photographed which apparently have up to 40 or more component strokes, no flashes having more than 14 strokes have been observed on records of the electrical fields of thunderstorms. The apparent discrepancy between the two methods of observation is explained by the fact that small momentary increases in the continuing current flowing to ground after some strokes are easily mistaken for component strokes on photographs taken with slow cameras. After the cessation of a discharge, the ionization of the lightning channel decreases at such a rate that a subsequent discharge to earth will require a fresh leader if it follows within an interval longer than about 15 msec; discharges following at shorter intervals are not preceded by leaders. The channel loses its ionization completely in about 100 msec. In general, the larger the number of component strokes, the longer is the duration of the flash, but there is no definite relationship between the number of strokes and the duration. Flashes of exceptionally long duration always have one or more very long intervals between two successive strokes and during these intervals there appears to be very little electrical activity in the cloud; it is suggested that the main progress of the discharge in the cloud takes place during the shorter intervals, so that flashes of long duration do not necessarily drain very extensive regions of charge. A.

551.594.221 : 538.566.2

8558. CORRELATION OF WHISTLERS AND LIGHTNING FLASHES BY DIRECT AURAL AND VISUAL OBSERVATION. M.G.Morgan.
Nature (London), Vol. 182, 332-3 (Aug. 2, 1958).

A recent extended observation of the progress of a storm at Hanover, New Hampshire, U.S.A., suggests that, although lightning flashes can generate whistlers, the majority of flashes do not. G.D.Sims

551.594.5 : 523.164.3

AURORAL RADIATION AT 500 Mc/s. See Abstr. 7646

551.594.51

8559. ON THE SCALE OF AURORAL MODEL EXPERIMENTS. L.Block.
Tellus, Vol. 8, No. 2, 234-8 (May, 1956).

The possibilities of scaling down the physical properties of gaseous discharges with altered linear dimensions are considered, with special reference to model experiments on aurorae. It is shown that the drift orbits can be transformed correctly, although the spiralling motion around the magnetic field lines cannot. This spiralling motion constitutes a very small ripple on the drift orbits in nature but a greater ripple in the experiments. However, this ripple seems to be of minor importance, and reasons are given for the view that the recent auroral experiments represent nature in a satisfactory way. A.

BIOLOGY

578.087.9 : 612.11 : 621.317.79

8560. A PHOTOCELL CATHETER FOR CONTINUOUS INTRA-CARDIAL AND INTRA-VASCULAR OXIMETRY. F.Bender.
Naturwissenschaften, Vol. 45, No. 1, 18 (1958). In German.

A new photocell catheter is described in detail, based upon earlier work of Kramer (Zeitschrift für Biologie, Vol. 95, 126, 1934) and Matthes (Archiv für experimentelle Pathologie u. Pharmakologie, Vol. 176, 683, 1934) which enables the rapid and accurate evaluation of the oxygen content of the blood at different points of its cycle, and will facilitate cardiac investigations. H.H.Hodgson

MEDICAL SCIENCE. HUMAN PHYSIOLOGY

612.843.32 : 537.312.5

PHOTOCONDUCTIVITY AND THE VISUAL RECEPTOR PROCESS. See Abstr. 7012

612.85

8561. ON THE MECHANISM OF BINAURAL FUSION.
E.E.David, Jr, N.Guttman and W.A. van Bergeijk.
J. Acoust. Soc. Amer., Vol. 30, No. 8, 801-2 (Aug., 1958).

A brief review is given of the work done by the authors in this field and of the varying conclusions reached by different workers. H.D.Parbrook

612.85

8562. DETECTING A SIGNAL IN NOISE.
L.A.Jeffress, H.C.Blodgett, C.L.Wood, III.
J. Acoust. Soc. Amer., Vol. 30, No. 8, 802 (Aug., 1958).

A clarification of some comments in a previous paper by the authors (Abstr. 4761/1956). H.D.Parbrook

612.85

8563. MEDIAL GENICULATE BODY — A DISAVOWAL.
L.A.Jeffress.
J. Acoust. Soc. Amer., Vol. 30, No. 8, 802-3 (Aug., 1958).

Withdrawal of a statement published previously (Journal of Comparative and Physiological Psychology, Vol. 41, 25-9, 1948) concerning a speculative centre for sound localization. H.D.Parbrook

614.898

8564. PROBLEM OF PROTECTION AGAINST RADIATION IN THE PEACEFUL APPLICATION OF ATOMIC ENERGY.
R.G.Jaeger.
Z. angew. Phys., Vol. 9, No. 9, 467-79 (Sept., 1957). In German.

This is a survey of the present state of the problem. The following topics are discussed: various units for the measurement of radiation doses; methods for measuring natural radiation levels and fixing permissible doses; proposals for protection on an international scale; the limits of permissible radiation levels; the special problems of protection in the operation of reactors; the elimination of radioactive fall-out. D.H.Lord

616.073.75 : 539.163

RADIOGRAPHY WITH ARTIFICIAL RADIOACTIVE ISOTOPES. See Abstr. 7330

LIST OF JOURNALS

The following list supplements the List of Journals published with the June number of Volume 60 (1957) and the Supplement published with the Index to the same volume. Reprints of the List of Journals and of the Supplement can be obtained from The Institution of Electrical Engineers, Savoy Place, London, W.C.2, price 2s.0d. post free.

The addresses given are believed to be correct at the date of publication, but no responsibility can be accepted for errors.

Bull. Tech. Univ. Istanbul	Bulletin of the Technical University of Istanbul (Istanbul Teknik Üniversitesi Bülteni). Gümüssyu, Istanbul. Formerly listed as: Istanbul Tek. Üniv. Bült.
Istanbul Tek. Üniv. Bült.	Istanbul Teknik Üniversitesi Bülteni (Bulletin of the Technical University of Istanbul). Now listed as: Bull. Tech. Univ. Istanbul.

ERRATA

Abstr. 509 (1958) line 2 : for "C.B.van Wyck" read " C.B.van Wyk".
Abstr. 1759 (1958) line 4 : for "L.I.Sarȳtcheva" read "L.I.Sarȳcheva".
Abstr. 6034 (1958) line 3 : for "185-32" read "185-232".
Abstr. 6558 (1958) line 7 : for "beas" read "betas".
Abstr. 6560 (1958) line 4 : for "there" read "three".
Abstr. 7506 (1958) line 2 : for "Johnston,W.J." read "Johnston,W.G."
Abstr. 7530 (1958) line 6 : for "cms" read "cm^3".

AUTHOR INDEX

Abdel Kerim Ibrahim Ali, 7725-6
Abdel Monem I.Kabiel, 7726
Abrahám,A., 7956
Abramova,T.S., 8001
Abrikosov,A.A., 7850
Abrosimov,A.T., 8090
Ackerman,M.E., 8188
Adey,A.W., 8553
Afrosimov,V.V., 8077
Agafonova,E.N., 7910
Agarwal,S.P., 8099
Agranovich,V.M., 8335
Agrawal,D.B., 7915
Aguilar,J., 8270
Aharoni,A., 8107
Ahnlund,K., 8323
Airapetyants,A.V., 7965
Airoldi,G., 8453
Akhiezer,A.I., 7856
Akishin,A.I., 8052
Albach,W., 8105
Aleksandrov,B.N., 8421
Alekseev,A.I., 8218
Alexander,J.M., 8352-3
Alexander,S., 8389
Ali Abdel Kerim Ibrahim, 7725-6
Alikhanyan,A.I., 8234, 8236
Allais,E., 8159
Allen,J.S., 8300
Allum,F.R., 8331
Al'pert,Ya.L., 8543
Alterman,Z., 8165
Altshuller,A.P., 8400
Amer,S., 8068
Andreyev,N.S., 8470
Anisovich,V.V., 8278
Apple,E.F., 7830
Apté,A., 7644
Arai,S., 8508
Archard,G.D., 8040
Armstrong,H.L., 7914
Armstrong,M., 8048
Arrott,A., 8114
Arshinov,A.A., 8064
Arthur,J.B., 7940
Ascoli,G., 7679
Aseev,G.G., 8375
Ashmore,A., 8224
Åström,E., 8038
Averbach,B.L., 7931
Azbel',M.Ya., 7969-70
Azhgireĭ,L.S., 8245
Azovskiĭ,Yu.S., 8375
Babayan,Kh.P., 8280
Bablidze,R.A., 7867
Bächler,W., 7751
Bachman,C.H., 8082
Bachynski,M.P., 8174
Badareu,E., 8003, 8011
Bagge,E., 8092
Baglin,J.E.E., 8331
Bair,J.K., 8345
Baker,E.B., 7738
Balabanova,L.A., 7944
Balashek,S., 7782
Banks,E., 8469
Bannik,B.P., 8281
Baranov,S.A., 8277
Bardócz,Á., 7794
Barnes,C.A., 8298
Barnes,R.G., 8434
Baron,S., 8361
Barrat,J.P., 7798
Barshay,S., 8241, 8253
Bashirov,R.I., 7936
Bass,F.G., 7896, 7967
Bass,F.H., 7653
Bates,L.F., 8140
Battaglia,A., 7825
Bauer,M., 8261
Baumel,P., 8254
Bayer,H., 7792
Bayh,W., 8045
Beck,P.A., 8449
Behringer,R.E., 8422
Belknap,D.J., 7995
Beltrametti,E.G., 8204
Bemski,G., 7952
Benczer-Koller,N., 8295
Bender,F., 8560
Benedict,T.S., 7889
Bennett,A.I., 8010
Bennett,R.G., 8509
Benoit,H., 8160
Bent,R.D., 8268
Bergmann,L., 7764
Bergmann,O., 7667
Berlincourt,D., 7892
Berman,A., 7874
Berman,A.S., 7741
Beynon,J.H., 8057
Bhatnagar,P.L., 8149
Bierman,A., 8058
Bilaniuk,O.M., 8266
Birkhoff,G., 7740, 8015
Biswas,S.N., 8087
Bittmann,C.A., 7952

Bjerke,K., 7661
Bjorklund,F., 8318
Blake,C., 7871
Blanc,D., 8062
Blandford,I., 8318
Blatt,F.J., 7899-900
Blevin,H.A., 7997
Bloch,C., 7700-1
Block,L., 8559
Blodgett,H.C., 8562
Blons,H., 7779
Bludman,S.A., 7686
Bockris,J.O'M., 8504
Bodansky,D., 8292
Boehm,F., 8298
Böer,K.W., 7975
Bogomolov,V.N., 7919
Boikova,A.I., 8527
Bollinger,L.M., 8305
Bonch-Bruevich,V.L., 7927
Bonet,A., 8264
Bonner,T.W., 8303, 8314
Booker,H.G., 8547
Boorse,H.A., 7874
Borelius,G., 7865
Borgardt,A.A., 7678
Born,M., 7715
Borodovskiĭ,P.A., 8158
Borovyk,Ye.S., 7753-4
Borowitz,S., 8207
Borshchevskiĭ,A.S., 8491
Bösenberg,W., 8518
Bötticher,W., 7801
Bouma,B.C., 7842
Bowen,T., 8258
Bowers,V.A., 8367
Bowker,J.K., 8237
Bradner,H., 8226
Bradt,P., 8500
Braid,T.H., 8300
Brame,D.R., 8464
Branscomb,L.M., 8071
Braude,S.Ya., 7653
Bravina,V.E., 7739
Bray,R.J., 7658-9
Brederlow,G., 8014
Bredov,M.M., 7944
Bremmer,H., 8173
Brennan,J.G., 8275
Brenner,R., 8153
Bresler,A.D., 8170
Brigman,G.H., 8370
Brockes,A., 8461
Brossel,J., 7798
Brown,D.A., 8380
Brown,R.R., 8096
Brown,S.C., 8049
Brown,W.B., 7712
Browne,C.P., 8273
Broyles,A.A., 8070
Bruce,C.F., 7845
Bruin,M., 8248
Brussel,M.K., 8222, 8263
Bryan,R.A., 8257
Bucka,H., 7802
Buechner,W.W., 8272
Burkhardt,G.H., 8211
Burman,R.L., 8300
Burns,W.G., 7727
Butler,J.W., 8316

Califano,S., 7828
Call,R.L., 8252
Callaby,D.R., 8141
Campion,P.J., 8286
Capps,R.H., 8199
Caputo,M., 8539
Carlson,E., 7839
Carlson,R.O., 7955
Carpenter,R.T., 8305
Carrington,A., 8390
Carte,A.E., 8554
Cashion,J.K., 8498
Castañs Camargo,M., 7717
Castillo-Bahena,R., 8215
Catalá,J., 8270
Catalá de Alemany,J., 8309
Catalán,M.A., 7800
Cavallo,L.M., 8294
Chamberlain,O., 8227
Chandrasekharan,V., 8483
Chappell,D.G., 8201
Charru,A., 8131
Chasanov,M.G., 8366
Chase,C.E., 7769, 7871
Chatterjee,S.K., 8171-2
Chavchanidze,V.V., 8198
Chelnokov,V.E., 7976
Chernikova,L.A., 7902
Cheroff,G., 7972
Chiarotti,G., 8444
Chirkov,A.K., 8133
Chistyakov,L.V., 8277
Chizh,L.D., 7962
Chkhartyshvili,Yu.V., 8447
Choudhury,N.K., 7837
Chretien,M., 8239
Chrien,R.E., 8263
Christy,R.W., 7906
Chu Chiao-Min, 8167
Chudesenko,É.F., 8543
Chuenkov,V.A., 7911
Chuvilo,I.V., 8225, 8334
Chzhou Guan-Chzhao, 8312
Cimbleris,B., 8359
Claesson,A., 8203
Clough,S., 8057
Clow,H., 8140
Cochet,R., 7878
Cochran,E.L., 8367
Cohen,B.L., 8356
Cohen,E.R., 7665
Cohn,H.O., 8345
Cole,T., 8368
Coleman,C.F., 8302
Colli,L., 8054, 8343
Collins,C.B., 7955
Conn,W.M., 8017
Conner,J.P., 8347
Contractor,S.N., 8172
Conway,B.E., 8504
Cook,C.S., 8301
Cool,R.L., 8255
Cooley,W.J., 8457
Corbett,J.W., 8451
Cordes,A.W., 8494
Corenzwit,E., 7980
Corrigan,J.J., 8100
Coryell,C.D., 8352
Coulson,C.A., 8397
Courtoy,C., 8382
Craggs,J.D., 8078
Craik,D.J., 8140
Crain,C.M., 8365
Cremer,E., 8467
Croitoru,N., 8465
Crowe,K.M., 7665
Crowe,W.J., 8168
Crowell,A.D., 8415
Crump,L.R., 7995
Cubicciotti,D., 7757
Cullen,T.L., 8284
Curcio,J.A., 8551
Czerny,M., 7828

Dalgarno,A., 8073
Danders,M., 8006
Dang Nguyen Van, 8135
Daniel,H., 8297
Das,J.N., 7948
Dash,W.C., 8517
Daum,L., 8190
David,E.E., Jr, 8561
Davidson,R.A., 8074
Davies,D.H., 8041
Davies,P.W., 8490
Davis,C.F., 8161
Davis,C.M., Jr, 8143
Davison,B., 8360
Day,G.A., 8516
Day,P.P., 8291
de Dominicis,C., 7701
Degeilh,A., 8062
de Groot,T., 7650
Deĭgen,M.F., 8430, 8448
Deĭgen,M.F. (Conf. rep.), 7907
Deĭhen,M.F., 8447
de Kluiver,H., 7799
de la Cuadra,M., 8270
De Marco,A., 8191
Demkov,Yu.N., 7708
Demȳdenko,O.A., 8447
Denney,J.M., 8451
Dennison,J.P., 8490
der Mateosian,E., 8344
DeShong,J.A., Jr, 8362
Deslattes,R.D., 8419
Desprez,S., 8085
de Swart,J.J., 8257
Deutscher,K., 7979
de Villers,P., 7778
de Vries,D.A., 7857
Dewhurst,H.A., 8507
de Wolf,E., 8132
Dexter,D.L., 8440
Dibeler,V.H., 8500
Dickey,F.P., 7808
Diddens,A.N., 8224
Dieke,G.H., 7839
Diemer,G., 7836
Dietrich,W., 8039
d'Incan,J., 7804
Diniak,A.W., 7750
Dmitriev,V.A., 8090
Dobryakova,F.F., 8543
Doleiden,F.H., 7953
Dollfus,A., 7657
Dorfman,Ya.G., 7990
Döring,W., 8414
Dörr,F., 7797
Dovzhenko,O.I., 8091
Draper,J.E., 8332
Drechsel,W., 8117
Drevinsky,P.J., 8353
Drozdov,S.I., 8321
Duchesne,J., 8397
Duckworth,H.E., 8374
Dudley,H., 7782-3
Duesterhoeft,W.C., 8365
Dumond,J.W.M., 7665
Dunell,B.A., 8482
Dunn,P.D., 8034
Dupuy,J., 7878
Durand,J.L., 7889
Dushin,N.V., 8244
Dyad'kin,I.G., 8228
Dykman,I.M., 7907

Easterday,H., 8240
Eastman,P.C., 7917
Eberbeck,W., 8024
Eccles,S.F., 8292
Eckart,G., 8175
Ecker,G., 8013
Eder,F.X., 7864
Edwards,M.H., 7866
Edwards,S.F., 7898
Ehrenburg,W., 7666
Ehrenson,S.J., 8393
Ehrlich,G., 8060
Eichhoff,G., 8018
Einspruch,N.G., 7776
Élsmont,V.P., 8355
Ekhlakov,A.D., 8481
Ellis,R.B., 7738
El Nadi,M., 8328
Emel'yanenko,O.V., 7937
Endt,P.M., 8288
Engardt,R.D., 8434
Engelmann,F., 7683
Englman,R., 7826
Eppe,R., 7950
Esel'son,B.N., 7867
Essen,L., 7664
Evans,T., 8464

Fain,W.W., 8365
Farago,P.S., 8221
Farnell,G.W., 7848
Faughnan,B.W., 8161
Fedorenko,N.V., 8077
Fedorova,M.F., 7754
Fedorovich,N.A., 7994
Feĭgina,F.I., 8118
Feĭnberg,E.L., 8420, 8428
Fenton,A.G., 8095
Fenton,K.B., 8095
Feofanov,G.N., 7770
Ferebee,S.F., 8143
Ferguson,J., 7833
Fernbach,S., 8318
Fiala,W.T., 7777
Fields,T.H., 8242-3
Filippov,S.S., 8350
Fireman,E.L., 8313
Firk,F.W.K., 8033
Firsov,Yu.A., 7918
Fischell,R.E., 8115
Fiske,M.D., 8451
Fitzky,H.G., 7812, 7819
Flinn,E.A., 7762
Flunkert,H., 7885
Fomin,P.I., 8206
Foner,S.N., 8367
Font,R., 8270
Forsyth,P.A., 7655
Foster,F.G., 8126
Fox,J.D., 8263
Fox,J.G., 8242-3
Fox,S., 8182
Frank,R.B., 8182
Franklin,J.L., 8500
Frauenfelder,H., 8269
Freed,S., 7817
Freedman,M.S., 8291
Frei,E.H., 8107
Fricke,G., 8371
Friedlander,S.K., 8511
Frieser,H., 8479
Fuller,C.S., 7953
Fulmer,C.B., 8356
Fulton,T., 8324
Fursey,A., 7796
Furst,M., 7835
Fürth,R., 8555

Gabovich,M.D., 8063
Galatry,L., 7811, 8407
Galkina,O.S., 7902
Gallagher,C.J., Jr, 8287
Galonsky,A., 8276
Ganesan,N., 8549
Gaponov,A.V., 8146
Gartenhaus,S., 8260
Gazzard,A.D., 8542
Gebhardt,W., 8404
Geguzin,Ya.E., 8436, 8489
Geiger,F.E., Jr, 8282
Gelberg,A., 8047, 8465
Gelsema,E.S., 8288

engnagel,H., 8121-2
erharz,R., 8468
erlich,D., 7943
ermagnoli,E., 8453
ermogenova,T.A., 7704
erold,V., 8025
ershuni,G.Z., 7859-60
ibson,A.F., 7930, 7940-1
ilbody,H.B., 8376
ill,P.S., 8097
intsburg,M.A., 7763
inzburg,I.F., 7681
inzburg,V.L., 7869
iovanelli,R.G., 7662
ladkovskiĭ,V.A., 8481
lendenin,L.E., 8357
lick,R.E., 8393
oetz,H., 7894
olant,V.E., 8001
oldberg,C., 7942
oldemberg,J., 8205
oldfinger,P., 8496
oldhaber,G., 8319
oldhaber,M., 8344
oldstein,J.S., 7687
oldstein,S., 7711
olitsyn,G.S., 8152
olubeva,L.A., 7882
orbunov,A.N., 8336-7
orbushenkov,V.A., 7863
ordienko,V.I., 8007
ordon,B.E., 8188
ordon,D.I., 8115
ordon,G.D., 8238
ordon,J.M., 7813
ordyakova,G.I., 7993
or'kov,L.P., 7982
oryunov,N.N., 8090
oryunova,N.A., 8491
ossett,C.R., 8316
race,M.A., 8265
raef Fernández,C., 7677
rahl,B.H., 7652
ranville,J.W., 7940
rashin,A.F., 7706
ray,E.P., 8310
ray,J.D., 8370
rechishkin,V.S., 8283
rechukhin,D.P., 8308
reen,J.W., 8272
reen,M., 7916
reenberg,H., 8207
reenblatt,M.H., 8185
ribnikov,Z.S., 7964
ribov,V.N., 7682
riffiths,P.M., 8140
rinberg,G.A., 8043
rishin,V.G., 8225
rivet,P., 8160
ross,F., 7746
rossman,P.U.A., 8486
rover,N.B., 7920
rümm,H., 8364
rünbaum,E., 8515
uffy,J.C., 8398
ugan,D., 8139
uibé,L., 8160
uidarelli,S., 7795
uier,W.H., 8310
ulyamov,U.G., 8281
umenyuk,V.S., 8061
ünther,K.G., 8406
uptill,E.W., 7766
urevich,I.I., 8088, 8235
ürsey,F., 7695
ustafson,W.A., 7729-30
utjahr,H., 7975
uttman,N., 8561
yorgy,E.M., 8128
yörgyi,G., 8296

Haas,G.A., 8080
Hack,M.N., 7702
Haefer,R., 8459
Hahn,H., 8484
Haibach,T., 7832
Haig,F.R., 8271
Hall,R.N., 7959
Halldén,U., 8552
Hallett,A.C.H., 7766
Halpern,I., 8292
Halsted,R.E., 7830
Hamilton,W.C., 8384
Hanna,S.S., 8299
Hanser,U., 8306
Hanszen,K.J., 8466
Hanysz,E.A., 7723
Harbeke,G., 8438
Harding,J.T., 8368
Hardy,J.,Jr, 8258
Harnik,E., 7920
Harris,G., 8254
Hart,A., 8136
Hart,J., 8155
Hart,R.W., 8310
Harte,W.E., 7906
Hartz,T.R., 7646
Harvey,F.E., 8083
Harvey,J.A., 8267, 8274
Hasted,J.B., 8376
Hauge,Ø., 7649
Haworth,C.W., 8458
Hayase,A., 8021, 8023
Haydon,S.C., 7997
Heikkila,W.J., 8553
Heineken,F.W., 7825
Heisen,A., 7847
Heller,C.A., 8495
Hellstrand,E., 8229
Henshaw,D.G., 8535
Herber,R.H., 8494, 8513
Herbert,J.M., 7880
Herlofson,N., 8084
Hernqvist,K.G., 7996
Herrmann,G., 8027
Herrmannsfeldt,W.B., 8300
Herron,J.T., 8500
Herzenberg,A., 8538
Hester,R.E., 8315
Hickmott,T.W., 8060
Hickok,R.L., 8332
Hilliard,J.K., 7777
Hillig,W.B., 7745
Hindmarsh,W.R., 7810
Hines,C.O., 7654
Hines,T., 8390
Hirakawa,H., 7818
Hirota,E., 8401
Hirshberg,Y., 8506
Höcker,K.H., 8364
Hodgson,T.S., 8188
Hoffman,J.M., 7808
Hofmann,H., 8145
Höhne,M., 7932
Holland,L., 8510
Holloway,J.H., 7664
Holthuizen,D.J., 8248
Hornig,W.A., 7740
Hough,P.V.C., 8266
Hudda,F.G., 8060
Hudspeth,E.L., 8348
Hughes,D.J., 8263, 8274
Hughes,E.E., 7750
Hume-Rothery,W., 8458
Hurd,R.A., 8163
Hurst,R.P., 8370
Husband,L.J.B., 7728
Huxtable,G.B., 8224
Huzita,H., 8103
Hyne,J.B., 8512

Ibrahim Ali Abdel Kerim, 7725-6
Iglitsyn,M.I., 7921-2
Ikeda,T., 7887-8
Il'in,R.N., 8077
Ilisavskiĭ,Yu.V., 7966
Imhof,W., 8240
Inchauspé,N., 8444
Ino,T., 8402
Ioffe,A.F., 7908
Ioffe,V.A., 7881
Isbell,W., 8226
Ishimura,T., 8022
Ito,D., 7696, 7698
Itoh,R., 8385-7
Itoh,T., 8395
Ivanov,V.E., 8375
Ivanov,Yu.M., 8230
Ivanova,N.S., 8354
Ivanter,I.G., 8251
Izhak,I.A., 7891

Jackson,J.D., 7716
Jaeger,R.G., 8564
Jaffe,H., 7892
Janin,J., 7804
Jarrett,H.S., 8388
Jeffress,L.A., 8562-3
Jen,C.K., 8367
Jennings,D.A., 8431
Jensen,J.T.,Jr, 8080
Jeunehomme,M., 8496
Jirlow,K., 8151
Johns,M.W., 8289
Johnson,C.E., 8265
Joigneau,S., 7905
Jones,C.M., 8276
Jongejans,B., 8248
Joshi,G.H., 8170
Joshi,M.C., 8307
Junger,G., 8055

Kabanov,B.N., 8505
Kabiel Abdel Monem I, 7726
Kaganov,M.I., 7896, 7967, 8108
Kalinin,V.A., 8412
Kalinkina,I.N., 7875
Kallmann,H., 7835
Kalogeropoulos,T., 8319
Kambe,K., 8395
Kan,L.S., 7989
Kane,J.A., 8242-3
Kangro,W., 7877
Kaplan,J.I., 8408
Kas'yankov,P.P., 8044
Katada,K., 8403
Katzman,J., 8094
Kaufman,A.N., 8069
Keck,C., 8181
Keffer,F., 8110
Keldysh,L.V., 7827, 7913
Keller,D.V., 8227
Keller,S.P., 7972
Kelley,E.M., 8126
Kelly,D.C., 8049
Kelly,J.M.,Jr, 8137
Kendell,R., 7780
Kennett,T.J., 8305
Kerr,J.T., 8374
Kersten,M., 8113
Kessler,F.R., 7960
Keuffel,J.W., 8252
Keyes,R.W., 7928
Khaikin,M.S., 7983
Khalatnikov,I.M., 7850
Khandelwal,D.P., 7838
Khodov,Z.L., 7765
Kholodenko,L.P., 7890
Khrenov,B.A., 8090
Khristiansen,G.B., 8089-90

Khutsishvili,G.R., 8435
Kihara,T., 8066-7
Kikuchi,M., 7938
King,W.J., 8289
Kingsbury,G.W.J., 7796
Kingston,R.S.T., 8486
Kirillov-Ugryumov,V.G., 8230, 8234, 8236
Kitaĭgorodskiĭ,A.I., 8531
Klein,E., 8479
Klein,H.M., 7757
Klein,R., 7870
Klier,M., 7844
Klimontovich,Yu.L., 7705
Klinger,M.I., 7946
Klüver,J.W., 8028
Knapp,E.A., 8240
Knapp,H., 8472
Knestrick,G.L., 8551
Kobzarev,I.Yu., 8250
Koch,W., 8046
Kogan,A.V., 7965
Kohara,S., 8449
Kohn,W., 8418, 8425
Kojima,S., 8394
Kokoulina,D.V., 8505
Kolm,C., 7931
Kolomoets,N.V., 7992
Komesaroff,M., 7647
Kompaneets,A.S., 7676, 7861-2
Kondorskiĭ,E.I., 7902
König,H., 8461
Kontorovich,N.P., 7910
Kontorovich,V.M., 7773, 8162
Kontsevoĭ,Yu.A., 7921-2
Konyukov,M.V., 8079
Kopaleishvili,T.I., 8327
Kopfermann,H., 8371
Koppe,H., 7722, 7985
Kopylova,D.K., 8281
Kotenko,L.P., 8234, 8236
Kotin,C.M., 7685
Kovalev,O.V., 8424
Kovrizhnykh,L.M., 8036
Kozhevnikov,O.A., 8091
Kraichnan,R.H., 8150
Kranz,J., 8117
Krausbauer,L., 7853
Kravtchenko,J., 7644
Krishnamurti,D., 7821
Krishnan,R.S., 8483
Krivoglaz,M.A., 8413, 8442
Kröner,E., 8485
Krugovykh,V.V., 8104
Kruschinski,L., 7824
Kruse,T.H., 8268
Kucher,T.I., 8441
Kudin,V.D., 7921-2
Kukanov,A.B., 7690
Kulenkampff,H., 8209
Kulin,S.A., 7931
Kumabe,I., 8340-1
Kumsishvili,V.A., 8198
Kunzler,J.E., 7901
Kushnir,Yu.M., 8053
Kushnirenko,A.N., 7909
Kutukova,V.M., 8235
Kuwabara,S., 8476
Kuznetsov,E.P., 8234, 8236
Kyhl,R.L., 8161

Lagerqvist,A., 7807
Laine,N., 8392
Laisk,E., 8184
Lamb,W.A.S., 8315
Lambe,J., 8443
Lämmermann,H., 7816
Landmark,B., 8544
Lapidus, 8195

Lautz,G., 8438
Lavrukhina,A.K., 8351
Lawson,J.D., 8030
Lax,M., 8426
Lazarev,B.L., 7989
Lazaryev,B.H., 7753-4
Lebedev,A.N., 8036
Le Claire,A.D., 8492
Lederhandler,S., 8439
Lee,E.W., 8141-2
Legrand,J.P., 8093
Lehnert,B., 8548
Leitner,J., 8239
Lenz,F., 8196
Levi,L., 8176
Levin,I., 7744
Levine,N., 8269
Lichtenberg,D.B., 8247
Liebfried,G., 8484
Lied,F., 8544-6
Lifson,H., 7761
Lihl,F., 8116
Lim,C.C., 7766
Lindeman,L.P., 8398
Lipkin,H.J., 7711
Lippmann,H., 7749
Litovitz,T., 7742
Littlejohn,C.S., 8329
Liu Shu-I, 8487
Loeffler,F.J., 8212
Loskutov,Yu.M., 7690
Lothian,B.W., 8123
Loughhead,R.E., 7658-9
Lowe,A.E., 8187
Lubchenko,A.F., 8427, 8445-6
Lübcke,E., 7784
Ludwig,W., 7715
Luk'yanov,S.Yu., 8005
Lund,L.M., 7741
Lyashenko,V.I., 7947, 7973
Lykos,P.G., 8134
Lynch,A.C., 8141
Lynn,N., 8378
Lyons,L.E., 7834
Lyubarskiĭ,G.Ya., 8424

McCabe,M.K., 7662
McCarthy,R.L., 8509
McCarty,M., Jr, 7805-6
McConnell,H.M., 8383
McCrary,J.H., 8314
McCrary,J.M., 8303
McCutchen,C.W., 8293
MacDowell,S.W., 8233
McGinnis,C.L., 8285
Mack,G., 8471, 8526
Mackenzie,J.D., 7745
Macmillan,D., 7791
McVoy,K.W., 8216
Madhavan,P., 8171
Magalinskiĭ,V.B., 7721
Mager,A., 8153
Maier-Leibnitz,H., 8032
Maĭkov,V.N., 8338
Mainberger,W.A., 7664
Malan,D.J., 8557
Maleev,P.I., 8189
Málek,Z., 8112
Mamasakheisov,V.I., 8327
Mandell,E.R., 8433
Mann,W.B., 8294
Mannheim,R., 7840
Maradudin,A.A., 8416
March,N.H., 7703
Marcuvitz,N., 8170
Margenau,H., 8049
Margulies,R.S., 7740
Maringer,R.E., 8520
Marschall,H., 8409
Marshak,R.E., 8257
Marshall,T.J., 7724
Martegani,A., 8346
Martens,G., 8946
Martin,A.J., 8524
Marutake,M., 7887
Marutyan,N.A., 8280
Maslenkova,G.L., 7820
Matevosyan,K.A., 8280
Matevosyan,R.O., 8133
Matossi,F., 7974
Matsen,F.A., 8370
Matthias,B.T., 7980
Maurer,K., 8032
Maxwell,E., 7871
Mazari,M., 8272
Mazur,P., 8416
Meakins,R.J., 7748
Meĭer,A.A., 7921
Melicherčík,J., 7886
Melton,C.E., 8076
Melvin,E.H., 7791
Menter,J.W., 8410
Mergault,P., 8503
Mermod,R., 8227
Merrit,J.S., 8286
Meshcheryakov,M.G., 8245
Meshkovskiĭ,A.G., 8246
Metnieks,A.L., 8555
Michaelson,S., 8425
Micheletti,S., 8054
Michels,A., 7799
Middelkoop,D., 7799
Mikhaĭlov,I.G., 7770, 7774
Milburn,R.H., 8238
Mileikowsky,C., 8193
Miller,M.A., 8146
Millett,W.E., 8215
Milne,T.A., 7756-7
Minami,S., 7696, 7698
Minematsu,M., 8394
Mingazin,T.A., 8529
Minten,A., 8405
Mishakova,A.P., 8088, 8235
Mitchell,W.H., 7958
Mitra,A.N., 8097
Mitropan,I.M., 8061
Mitskevich,N.V., 7709
Mitsuk,V.E., 8016
Miyatani,S., 7933
Miyazawa,T., 8379
Mizuno,H., 8456
Moak,C.D., 8276
Model',I.Sh., 7831
Mohamed,A.A., 8459
Moĭzhes,B.Ya., 7929
Moles,A., 7785
Moll,J.L., 7957
Möllenstedt,G., 8055
Montroll,E.W., 8416
Moore,A., 8524
Moore,D., 8187
Moore,E.J., 7897
Moore,R.G., 8348
Moore,W.H., 8258
Morehead,F.F., Jr, 7841
Morgan,I.L., 8348
Morgan,M.G., 8558
Morino,Y., 8401
Morita,S., 8342
Morita,T., 7719-20
Morozova,A.M., 8118
Morris,B., 7727
Morris,G.J., 8252
Morris,T.W., 8255
Mortlock,A.J., 7873
Mossop,S.C., 8554
Mühlschlegel,B., 7985
Müller,K.G., 8013
Muller,T., 8288
Mullett,L.B., 8035
Mulliken,R.S., 8399
Mulvey,T., 8040
Murakawa,K., 7803
Murphy,A., 8178
Murzina,E.A., 8104
Muschlitz,E.E., Jr, 8075
Müser,H.E., 7885
Musin,A.K., 8064
Myasnikov,V.A., 7919

Nablo,S.V., 8289
Nagakura,S., 8475
Nagamiya,T., 8109, 8528
Nagarajan,M.A., 8330
Nakagawa,S., 8103
Nakagawa,Y., 8120
Narasimhan,P.T., 8392
Náray,Z., 7978
Nash,W.F., 8231
Nasledov,D.N., 7934, 7937, 7951 8521
Nasuhoglu,R., 8357
Nguyen Van Dang, 8135
Nickson,A.F.B., 7786
Niemann,F.L., 8237
Nikol'skiĭ,B.A., 8088, 8235
Nikol'skiĭ,S.I., 8091, 8104
Nishikawa,T., 8381
Nishimura,K., 8317
Nitsovich,V.M., 7912
Nolin,B., 8509
Nöller,H.G., 7751-2
Nomofiliv,A.A., 8281
Norbeck,E., Jr, 8329
Nordfors,B., 8019
Novey,T.B., 8298
Nowak,W., 7710
Nozdrev,V.F., 7775

Oberhauser,F., 7954
Obraztsov,Yu.N., 7929
O'Connor,T.C., 8555
Ogata,H., 8340
Ogawa,S., 8394
Ohkawa,T., 8067
Oka,T., 7818, 8401
Okada,J., 7923
Okaya,Y., 7883, 8525
Oki,S., 8340
Okudaira,K., 8103
Olson,R., 7987
Olsson,I., 8180
Oncescu,M., 8460
Orear,J., 8254
O'Reilly,D.E., 8432
Orhaug,T., 8545
Orlov,A.N., 8020
Osberghaus,O., 8404-5
Osipenkov,V.T., 8350
O'Sullivan,W., 8110
Owen,G.E., 8324

Pachner,J., 7671-2, 7680
Pafomov,V.E., 8051
Paige,E.G.S., 7940-1
Pal,M.K., 8330
Palacios,J., 7668
Palevsky,H., 8263
Pankove,J.I., 8437
Pant,D.D., 7838
Papapetrou,A., 7673-4
Parr,R.G., 8134, 8369
Parry,J.V.L., 7664
Parthasarathi,M.N., 8449
Partridge,W.S., 8074
Passau,P., 8382
Patel,J.R., 8439
Patrakova,A.Ya., 8521
Paul,W., 8059
Pauli,W., 8497
Paulin,A., 8037
Pauly,H., 8377
Pavinskiĭ,P.P., 7822
Pavlotskaya,F.I., 8351
Peck,A.J., 7857
Pekar,S.I., 8430
Pekeris,C.L., 7761, 8165
Penselin,S., 8371
Pepinsky,R., 7883, 8525
Perez-Mendez,V., 8240
Perri,J.A., 8469
Perry,R.P., 7852
Pessel,H., 7767-8
Peter,M., 7879
Petrukhin,V.I., 8245
Pfahnl,A., 7829
Philippot,J., 7718
Phillipson,P.E., 8399
Piette,L.H., 8391
Pignanelli,M., 8343
Pikus,G.E., 7945
Pilat,I.M., 7962
Pimonow,L., 7781
Pines,B.Ya., 8473-4
Pinkston,W.T., 8275
Pistorius,C.A., 7842
Pitaevskiĭ,L.P., 7869, 7968
Pitman,D.T., 8455
Pivovar,L.I., 8007
Podgoretskiĭ,M.I., 8281
Pointon,A.J., 8231
Polanyi,J.C., 8498
Pollak,L.W., 8555
Polotskiĭ,I.G., 7765
Polovin,R.V., 8157
Pomeranchuk,I.Ya., 8219
Pomerantz,M.A., 8099
Popescu,I., 8003
Popov,Yu.S., 8234, 8236
Porai-Koshits,E.A., 8470, 8527
Porile,N.T., 8279
Porter,F.T., 8291
Post,B., 8469
Potnis,V.R., 8099
Potter,R.J., 8440
Prener,J.S., 7830
Preston,R.S., 8299
Preston,W.M., 8237
Prieto,C.,F.E., 7692
Protopopov,A.N., 8355, 8358
Prutton,M., 7884
Putley,E.H., 7958
Pütter,P.S., 8065
Puzikov,L.D., 7077

Quistwater,J.M.R., 8482

Rabenhorst,H., 7886
Rabinovich,I.B., 7863
Raboy,S., 8357
Rabson,T.A., 8303
Raczka,A., 8210
Raczka,R., 8210
Raĭzer,Yu.P., 7861-2
Rajagopal,E.S., 8483
Rakhimbaev,B.G., 8281
Rakobol'skaya,I.V., 8091
Ramachandra Rao,B., 8179
Raman,C.V., 8522
Rammensee,H., 7832
Rang,O., 8536
Ranken,W.A., 8303, 8314
Rapoport,I.D., 8086
Rasmussen,J.O., 8287
Rau,R.R., 8255
Rawer,K., 8540
Ray,G.D., 7772
Raychaudhuri,A., 7670
Reder,F.H., 7664
Redhead,P.A., 8009

Redington,R.W., 7971
Redmond,P.J., 7689
Regge,T., 7697, 7699
Reich,G., 7752
Reimer,L., 7903
Reinhard,H.P., 8059
Reinov,N.M., 7965, 8130
Renton,C.A., 7901
Reynolds,G.T., 8192, 8258
Riddell,J., 8373
Riecke,W.D., 8478
Ringo,G.R., 8357
Roberts,J.A., 7648
Roberts,W.H., 8119
Robinson,A.C., 8123
Robinson,F.N.H., 8031
Robinson,G.B., 8282
Robinson,G.W., 7805-6
Roch,J., 8194
Rodionov,K.P., 8481
Rodionov,Yu.F., 8277
Rodriguez,S., 7987
Rogers,M.T., 8392
Ronchi,V., 7851
Rose,D.C., 8095
Rose,H.J., 8304
Ross,M., 8247
Rossi,A., 8269
Rosskopf,F., 7877
Rössler,F., 7793
Rostomyan,M.G., 8280
Rothman,H., 8004
Rothwell,P., 8098
Rotman,G., 8002
Rotter,F., 7787
Rourke,F.M., 8056
Rowlands,G., 8139
Rücker,D., 7843
Rudström,L., 8019
Ruedl,E., 8467
Ruelle,D., 7694
Ruppel,W., 7961
Rustgi,M.L., 8333
Rüttiger,K., 8209
Ryazanov,M.I., 8200
Rybak,S.A., 8442
Rytz,A., 8343
Ryvkin,S.M., 7965, 7976-7, 8189

Safronov,B.G., 8375
Sahay,J.N., 8502
Saint Pierre,L.E., 8507
Saitov,I.S., 8225
Sakurai,J.J., 8249
Salvetti,C., 8054
Samios,N.P., 8239
Samsonov,G.V., 8454
Samylov,S.V., 7831
Sancier,K.M., 7817
Sander,K.F., 8041
Sandmann,W.H., 8252
Sandström,A.E., 8019
Sangiust,V., 8290
Sanna,R., 8191
Sannikov,D.G., 8372
Saroléa,L., 7722
Satterthwaite,C.B., 7935
Saunders,M., 8512
Sauter,E., 7855
Sauter,F., 8065
Savina,L.I., 7770
Sawada,M., 8021-3
Sawicki,J., 8320
Saxton,J.H., 7854
Sayre,E.V., 7817
Scheidegger,A.E., 8452
Schikarski,W., 8214
Schmid,G., 7767-8
Schmidt,G., 7893
Schmidt,H., 7684
Schmidt,T., 8409
Schmidt-Rohr,U., 8297
Schmutzer,E., 7675
Schneider,W.G., 7833
Schnell,J., 7960
Schönhofer,A., 8423
Schorygin,P., 7824
Schrüfer,E., 7735
Schubert,G.U., 7986
Schüepp,W., 8550
Schuster,K., 7733
Schwartz,C., 8260
Schwartz,M., 8239
Schwarzschild,A., 8295
Schwentek,H., 8541
Scott,M.J., 8223
Scurlock,R.G., 8265
Seehof,J., 8048
Segrè,E., 8227
Seiler,H., 8055
Seliger,H.H., 8294
Selin,L.E., 7807
Senent,F., 8264, 8270
Senise,J.T., 8029
Senitzky,B., 7957
Sery,R.S., 8115
Setty,P.S.V., 8156
Sexl,T., 7732
Sexton,M.C., 8078
Shaduri,R.S., 8198
Shalamov,Ya.Ya., 8246
Shapiro,B.S., 8543
Shapiro,F.L., 8349
Shatzkes,M., 8366
Shebanov,V.A., 8246
Sheffield,J.C., 8056
Shekhter,V.M., 8202
Sherwood,R.C., 8126
Shevchenko,V.G., 8334
Shida,S., 8508
Shimomura,K., 8532-4
Shiraiwa,T., 8022
Shirkov,D.V., 7681
Shirobokov,M.Ya., 7890
Shirokov,M.I., 8312
Shirokov,Yu.M., 7713
Shiryaev,B.M., 8358
Shishkin,G.V., 8277
Shishkin,L.A., 7856
Shmatov,V.T., 8111
Shtrikman,S., 8107
Shvets,A.D., 7867
Signell,P.S., 8257
Silberberg,R., 8319
Silberg,P.A., 8082
Silin,V.P., 8429
Sillitto,R.M., 7849
Silsbee,R.H., 8450
Simon,G., 7760
Simpson,J.A., 7870
Sinani,S.S., 7993
Sinel'nikov,K.D., 8375
Singer,S.F., 8100
Sinitsyn,V.I., 8005
Sjögren,B., 8322-3
Skarsvåg,K., 8186, 8224
Skorka,S., 8092, 8102
Skribeland,S., 8544
Skrotskiĭ,G.V., 8111
Skryshevskyi,A.F., 7747
Slezov,V.V., 7896
Slichter,W.P., 8433
Slivkov,I.N., 8008
Slobodchikov,S.V., 7934
Smel'makh,M.F., 8130
Smith,A.J., 8272
Smith,J.E., 7738
Smithberg,S., 8048
Smushkov,I.V., 8473-4
Smyrnov,A.A., 7895
Snitko,O.V., 7973
Snyder,L.C., 8369
Sobel'man,I.I., 8428
Sodha,M.S., 7915, 7917
Sokolov,A.V., 8020
Sokolov,B.V., 7951
Sokolov,I.A., 7965
Solonnikova,L.A., 8454
Solov'eva,V.I., 8090
Soroko,L.M., 8220
Spicer,B.M., 8331
Spielberg,K., 7732
Spiewak,M., 7981
Spiridonov,V.M., 8336-7
Springer,T., 8032
Sreekantath,G.M., 7790
Srirama Rao,M., 8179
Srivastava,C.M., 8156
Stahelin,P., 8300
Stallwood,R.A., 8242-3
Staub,H., 8213
Stavinskiĭ,V.S., 8335
Stavitskaya,T.S., 7991
Stech,B., 8298
Steele,S.R., 8455
Ştefănescu,S.S., 8154
Steinberg,E.P., 8357
Steinberger,J., 8239
Steiner,H.M., 8227
Stekhanov,A.I., 7823
Stephens,W.E., 8213
Stephenson,G., 7669
Steudel,A., 7846
Stewart,C., 7759
Stil'bans,L.S., 7991, 7994
Stitt,R.K., 8252
Stokes,C.S., 7771
Stolovy,A., 8267
Stotz,S., 7846
Stow,R.W., 7872
Stoyanov,I.O., 7895
Strandberg,M.W.P., 8161
Stratton,R., 7939
Street,J.C., 8237-8
Strelkov,P.G., 7875
Streng,A.G., 7771
Streng,L.A., 7771
Stribel,T., 8514
Strokan,N.B., 7976-7
Strotzer,G., 7755
Subba Rao,B.N., 8307
Suchy,K., 8540
Sucksmith,W., 8123
Sugihara,T.T., 8353
Suhl,H., 7980
Sullivan,J.O., 8501
Surkova,L.V., 8088, 8235
Sushkin,N.G., 8053
Sutton,R.B., 8242-3
Suzuki,A., 7949
Sweeney,M., 8287
Swetnick,M.J., 8100
Sytenko,O.H., 8325
Székely,A., 8072

Tachiki,M., 8109
Tagliaferri,G., 8258
Takekoshi,E., 8340
Takhtareva,N.K., 8491
Tamai,E., 8103
Tamm,I.E., 8250
Tanaka,H., 7696, 7698
Tanaka,M., 8394
Tanttila,W.H., 8431
Tatsumoto,E., 7988
Tatsuzaki,I., 8396
Tauc,J., 7956
Taylor,C.A., 8523
Taylor,R.T., 8265
Taylor,S., 8254
Teplov,I.B., 8326
Terletskiĭ,Ya.P., 7721
Theis,W.R., 7691
Thies,H.H., 8331
Thommen,K., 8463
Thompson,B.J., 8523
Thompson,D.J., 8034
Thorndike,A.M., 8255
Thouvenin,J., 7905
Thuronyi,G., 8556
Tichý,J., 7758
Tietz,T., 7710, 8106
Tolhoek,H.A., 8256
Tolmachev,V.V., 8417
Tolpygo,K.B., 7907, 7964
Tomasini,G., 8191
Tompkins,J.E., 8169
Toraldo di Francia,G., 7789,8164
Traughber,R.L., 8276
Treiman,S.B., 7716
Treves,D., 8107
Trey,F., 7954
Trice,J.B., 8183, 8363
Trifonov,E.D., 7714
Troianello,E.J., 8353
Truell,R., 7776
Tsarenkov,B.V., 8521
Tschoegl,N.W., 8480
Tsintsadze,N.L., 8157
Tsubomura,H., 7815
Tsukerman,V.A., 7831
Tsukernik,V.M., 8108
Tsuneoka,Y., 8340
Tsutsumi,K., 8021, 8023
Tsuzuku,T., 8519
Tsyn,N.M., 7753-4
Tsytovich,V.N., 8147
Tubaev,V.M., 8007
Tuchkevich,V.M., 7976
Tucker,D.G., 7780
Tucker,P.E., 8074
Turney,T.A., 7814
Tyablikov,S.V., 8417
Tyapkin,A.A., 8221
Tyutyunnikova,E.V., 7882

Überall,H., 8296
Ueno,S., 7663
Ukhanov,Yu.I., 7963
Ure,R.W., Jr, 7935
Uretsky,J.L., 7689
Uretz,R.B., 7852
Usmanova,M., 8281
Ust'yanov,V.I., 7904

Vachenya,S.A., 7990
Val'kov,V.I., 7820
Valle,P.E., 8537
van Bergeijk,W.A., 8561
Van Bladel,J., 8166
Van Dang Nguyen, 8135
van der Houven van Oordt,A.J., 7836
van Geel,W.C., 7842
van Gerven,L., 8132
Van Horn,D.D., 8457
van Itterbeek,A., 8132
Van Regemorter,H., 7809
van Wyk,C.B., 8197
Vedam,K., 7883
Venkatesan,D., 8101
Verghese,C.A., 7790
Verkin,B.I., 8421
Vervier,J.F., 8346
Villar,E., 8264
Vinci,D., 7788
Vise,J.B., 8295
Visser,S.W., 7660

Vitale,S., 8204
Vitovskiĭ,N.A., 8189
Voigt,F., 8127
Voigtlaender-Tetzner,G., 7743
Voltsekhovskaya,I.A., 7882
Voltyshen,S.Yu., 7962
v. Behr,J., 8232
v. Ehrenstein,D., 8371
v.Kienlin,A., 8124-5, 8138
v.Krzywoblocki,M.Z., 7729-31
Vonsovskiĭ,S.V., 7909
von Zahn,U., 8059
Voronyuk,P.I., 7946
Voss,G.A., 8105
Vzorov,I.K., 8245

Wächter,F., 8011
Wagner,F., Jr, 8291
Wait,J.R., 8178
Walker,R.M., 8451
Walter,H., 7656
Warburton,E.K., 8304
Waring,W., 8455
Warshaw,S.D., 8217
Wataghin,G., 7688
Watanabe,H., 8129
Waters,W.E., 8026
Weaver,E.R., 7750
Weaver,H.E., 8391
Wegener,H., 8208
Weidlich,W., 7693
Weiss,G.H., 8416
Weissman,S.I., 8506
Welsby,V.G., 7780
Wenk,F., 7736
Wentink,T., Jr, 8501
Wentzel,D.G., 7734
Werbrouck,A.E., 8258
Wertheim,G.K., 7924
West,E.J., 8443
White,F.A., 8056
White,J.W., 7834
Whittemore,W.L., 8255
Wiedemann,W., 7984
Wienecke,R., 7999-8000
Wilke,K.T., 7840
Wilkinson,R.W., 7727
Willard,H.B., 8345
Williams,A., 8073
Williams,H.J., 8126
Williams,J.H., 8222
Williamson,C.F., 8348
Willis,J.E., Jr, 8345
Wilson,M.D., 7849
Winkler,G.M.R., 7664
Wolga,G.J., 8161
Wolsky,S.P., 8462
Wood,C.L.,III, 8562
Woodside,W., 7858
Wray,K.L., 8501
Wright,D.B., 8524
Wright,G.A., 7814
Wroe,H., 8012
Wu,C.S., 8295
Wyld,H.W., Jr, 7716

Yamada,R., 8177
Yamaguchi,S., 8477
Yamaguti,T., 7998
Yamamoto,M., 8488
Yamazaki,H., 8508
Yao Fu-Den, 8042
Yavor,I.P., 8339
Yeatts,L.B., Jr, 8493
Yokozawa,Y., 8396
Yomosa,S., 8528
Yoshida,U., 7949
Young,L.A., 8238
Young,O.B., 8083
Young,W.H., 7703
Ypsilantis,T., 8227
Yunovich,A.É., 7925-6
Yur'ev,B.A., 8326
Yurkov,B.Ya., 8050

Zahn,W., 7894
Zähringer,J., 8313
Zaikin,D.A., 8262
Zaĭtsev,A.A., 8016
Zaĭtsev,V.M., 7876
Zanker,V., 7832
Zatsepin,G.T., 8104
Zel'dovich,Ya.B., 7861-2
Zel'tser,G.I., 8259
Zemansky,M.W., 7874
Zeuli,T., 8148
Zevin,V.Ya., 8448
Zhdanov,G.B., 8311
Zhdanov,G.S., 8529
Zheleznyakov,V.V., 7651
Zhukhovitskiĭ,E.M., 7859-60
Zhuravlev,N.N., 8529-30
Zidarov,D., 7645
Zil'berman,G.E., 8144
Zimmerman,J., 8509
Zimmerman,R.L., 8263
Zinherman,Ya.P., 8081
Zinov'eva,K.N., 7868
Zoli,M.T., 7789
Zrelov,V.P., 8221, 8245
Zucker,I.J., 8411
Zurmühle,R., 8343
Zwanzig,R.W., 8499
Zyryanov,P.S., 7737

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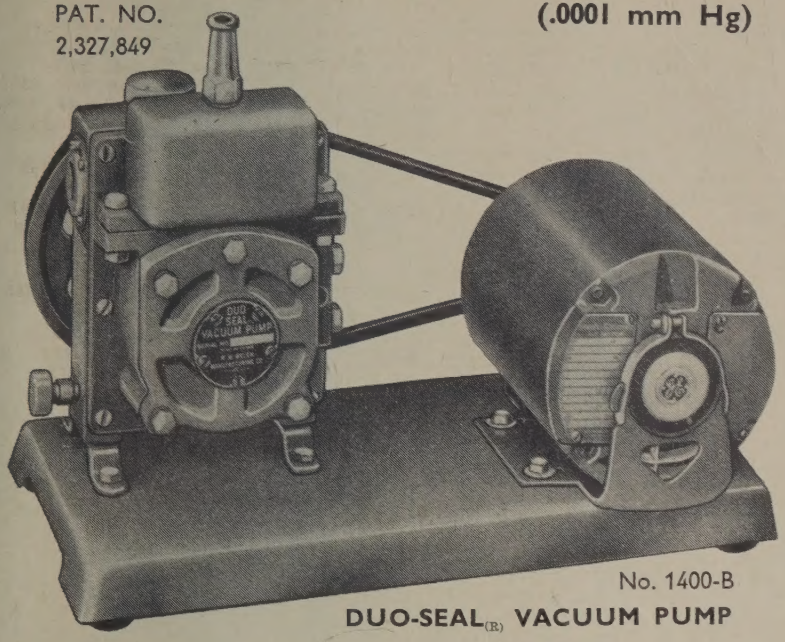

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